STANFORD RSL TECHNICAL REPORT NO. 73-1

National Aeronautical and Space Administration

Research Contract NAS 5-21733

FIELD STUDIES IN SUPPORT OF NIMBUS-E SURFACE COMPOSITION MAPPING RADIOMETER

R. J. P. Lyon
Principal Investigator

A. A. Green
Research Associate

May 25, 1973

REMOTE SENSING LABORATORY
SCHOOL OF EARTH SCIENCES

STANFORD UNIVERSITY ∘ STANFORD, CALIFORNIA

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INTRODUCTION

Infrared spectral analysis of terrain material which has been conducted since 1964 (Lyon, 1964) has demonstrated that there is a systematic increase in the wavelength of the silica reststrahlen emission minimum with decreasing silica content. Thus a potential exists to extract chemical information from the wavelength dependent changes in emission found between different rock types. As this reststrahlen band is in general the major spectral feature in the 7-14μ atmospheric window it is not necessary to record the emission under high resolution at a large number of wavelength intervals; two channels with correctly chosen spectral responses should be sufficient to characterize any wavelength shift in the emission minimum. These channels can also be chosen with sufficiently wide bandpasses to enable the use of imaging systems without losing the required spectral resolution.

Although the image produced from each channel conveys only apparent temperature information, a study of the differences between the two images reveals that silicic rocks will have a higher apparent temperature in the long wavelength channel. This trend will tend to reverse for rocks of lower silica content and the emission minimum shifts into the longer wavelength channel.

If the outputs of the two channesl are spacially registered and combined to generate a third variable which reflects the differences between the two outputs, then this variable can then be redisplayed in

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LYON, R. J. P. (1964) Evaluation of Infrared Spectrophotometry for the Compositional Analysis of Lunar and Planetary Soils, NASA Contractor Report, NASA CR-100.

image form and its magnitude should be relatable to the silica content of the rocks imaged.

Two methods have been proposed for generating this third variable, the first is to take the difference in apparent temperature between the two channels and the second is to ratio the voltage outputs of the two channels. If V_1 and V_2 represent the instrumental responses in the short and long wavelength channels respectively then the first method should use

$$\Delta T = F_2(V_2) - F_1(V_1)$$

where F_1 and F_2 are the functional relations between temperature and channel output obtained by calibrating the instrument against reference blackbody sources. In the ratio method we consider the ratio V_1/V_2. With this type of experiment in mind several thermal infrared multichannel scanning systems have been used to carry out surface composition mapping (Vincent, et. al., 1972; W. Hovis, 1972). The purpose of this work is to simulate and study the behavior of these systems over rock units which have been studied already with an airborne infrared spectrometer system (R. J. P. Lyon, 1972). The responses of the two channel High Resolution Surface Composition Mapping Radiometer (HRSCMR) and the thermal channels of the MSDS scanner have been calculated from data recorded with the NASA IR pallet and simulate the output of these systems had they been flying over the same targets as the IR pallet.

VINCENT, R. K., Fred THOMSON and Kenneth WATSON (1972) Recognition of Exposed Quartz Sand and Sandstone by Two-Channel Infrared Imagery, Journal of Geophysical Research, Vol. 77, May 10, 1972, p. 2473-2477.

HOVIS, W. (1972) Data on the Nimbus-E High Resolution Surface Composition Mapping Radiometer, Private Communication.

LYON, R. J. P. (1972) Infrared Spectral Emittance in Geological Mapping: Airborne Spectrometer Data from Pisgah Crater, California, Science, Vol. 175, March, p. 983-986.

SIMULATION OF SCANNER OUTPUTS

(a) Calculation Procedure

An analysis of the aircraft-recorded, infrared spectra has been described elsewhere (Lyon and Marshall, 1971; Lyon and Green, 1972). This basic data has been used in these calculations.

The voltage, V, generated by the spectrometer is proportional to the difference between the radiance level reaching the spectrometer, $L_s(\lambda)$, and that of an internal reference blackbody, $L_r(\lambda, T_{ref})$. The constant of proportionality, At, is dependent on both the optical transmission of the instrument and the electrical gain involved.

$$V = At(L_s - L_r(T)) \text{ at any given } \lambda \tag{1}$$

The value of At was established by ground-based calibration of the instrument against standard blackbody sources. The data system in the IR pallet provides voltage readings at 88 wavelengths in the 7-14μ region. Each spectrum takes approximately 1/6 second to be measured. The terrain overflown has been divided into geologically significant regions (see Table I) and the spectra recorded in each region can then be compared in a discussion of the discriminating ability of the systems used.

The system response, V_i, of a scanner is given by

$$V_i = A \int_0^{\infty} \phi(\lambda) \, L_s(\lambda) \, d\lambda$$

LYON, R. J. P., and A. A. MARSHALL (1971) Operational Calibration of an Airborne Infrared Spectrometer over Geologically Significant Terrains, IEEE Transactions on Geoscience Electronics, Vol. GE-9, July, p. 131-138.

LYON, R. J. P., and A. A. GREEN (1972) Infrared Spectrometry Studies -- New Format Presentation of Infrared Spectral Emittance Data, Stanford RSL Technical Report, No. 72-2.

TABLE I

DESCRIPTIONS OF SPECTRAL GROUPS - ON FLIGHT 1 LINE
AIRBORNE SPECTRA

MX108-1-PISGAH

LOC	NAME	NO. OF SPECTRA	GMT START	GMT STOP
1.	Alluvium C	25	18:49:44078	18:49:51360
2.	Alluvium AC	30	18:50:22915	18:50:31410
3.	Sand over Basalt II-C	11	19:09:23685	19:09:26719
4.	Alluvium A	26	18:49:58035	18:50:05923
5.	Alluvium B	30	18:50:35050	18:50:43864
6.	Sand over Basalt I-B	21	19:08:37569	19:08:43636
7.	Sand over Basalt I-A	9	18:50:52041	18:50:54468
8.	Pisgah Flow III	6	19:08:27252	19:08:28784
9.	Pisgah Flow II	4	19:08:25750	19:08:26647
10.	Pisgah Flow I	15	19:08:20896	19:08:25143
11.	Lava Flow II-A	13	18:51:04785	18:51:13887
12.	Lava Flow II-D	9	19:08:12083	19:08:16649
13.	Pisgah Lava III-A	8	18:51:16921	18:51:22383
14.	P-Train Lava (not included)	31	19:07:57521	19:08:06623
15.	Pisgah Lava III-B	8	18:51:23596	18:51:28452
16.	Pisgah Lava III-C	18	18:51:29058	18:51:34231
17.	Lava III-G	10	19:07:48418	19:07:55701
18.	Pisgah Lava III-D	12	18:51:34837	18:51:38161
19.	Lava III-H	8	19:07:40241	19:07:46309
20.	Pisgah Lava II-F	20	18:51:47263	18:51:53332
21.	Lava III-J	16	19:07:31746	19:07:39317
22.	Alluvium D	21	18:51:58186	18:52:04254
23.	Lava I-K	16	19:07:15652	19:07:20506
24.	Lava II-C	10	19:07:08371	19:07:14439
25.	Lava Flow II-B	10	18:52 12461	18:52:16998
26.	Pisgah Lava I-E	19	18:52:19136	18:52:25204
27.	Dry Lake Sediments B	23	19:06:44098	19:06:50774
28.	Dry Lake Sediments A	53	18:57:38314	18:57:54090
29.	Dry Lake Sediments C	25	19:06:34390	19:06:41671
30.	Alluvium F	42	19:06:14078	19:06:26501
31.	Alluvium E	27	18:52:59793	18:53:07681
44.	Pisgah Cinders I	4	18:50:55076	18:50:56000
45.	Pisgah Cinders II	5	18:50:56607	18:50:57821
46.	Pisgah Cinders III	9	18:50:58427	18:50:00855
54.	Pisgah Lava III (A-D)	53	18:51:21169	18:51:36948

MX108-1-SUNSHINE

LOC	NAME	NO. OF SPECTRA	GMT START	GMT STOP
40.	Sunshine Lava A	22	18:57:11905	18:57:18290
41.	Sunshine Lava B	25	18:57:04017	18:57:11297
42.	Sunshine Cinders C	17	18:56:54626	18:56:59480
43.	Sunshine Cinders D	20	18:56:47633	18:56:53412

VARIOUS

LOC	NAME	NO. OF SPECTRA	GMT START	GMT STOP
53.	Palmdale Lake	44	17:12:38496	17:12:52143

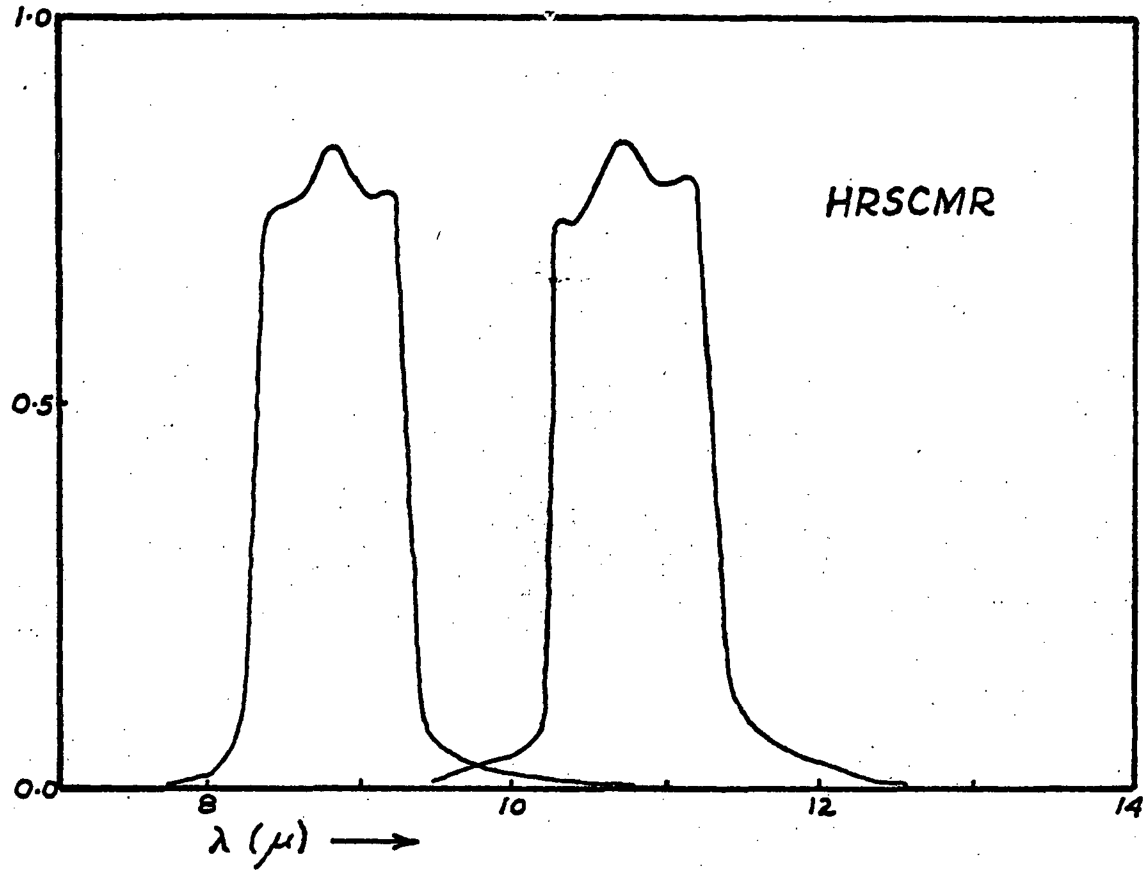
where A is a constant gain factor, $\phi(\lambda)$ is the spectral response of the instrument, and $L_s(\lambda)$ is the spectral radiance received by the instrument from instantaneous field of view below the aircraft.

This response can be approximated by the summation

$$V_i \sim \sum_{j=1}^{88} \phi_j L_j$$

where $L_j = L_s(\lambda_j)$ are the radiances found from a solution of equation (1) in the analysis of the spectrometer data. It should be noted that the V_i values quoted here have been calculated from the above formula and will be directly proportional to the instrumental output depending on some constant instrumental gain factor. The spectral responses $\phi_i(\lambda)$ for each channel are shown in Figure I and listed in Table II. The averaged instrumental responses for each rock type are given in Table III. In an attempt to compare the two methods of displaying the differences between the responses in adjacent channels the apparent temperatures in both channels were calculated for the HRSCMR. This was done by replacing L_j with $B_j(T)$ in the above equation and calculating a look-up table of instrument response against blackbody temperature, where $B_j(T)$ was calculated with the Planck relation. These temperatures are shown in columns 1 and 2 of Table IV.

SPECTRAL RESPONSES



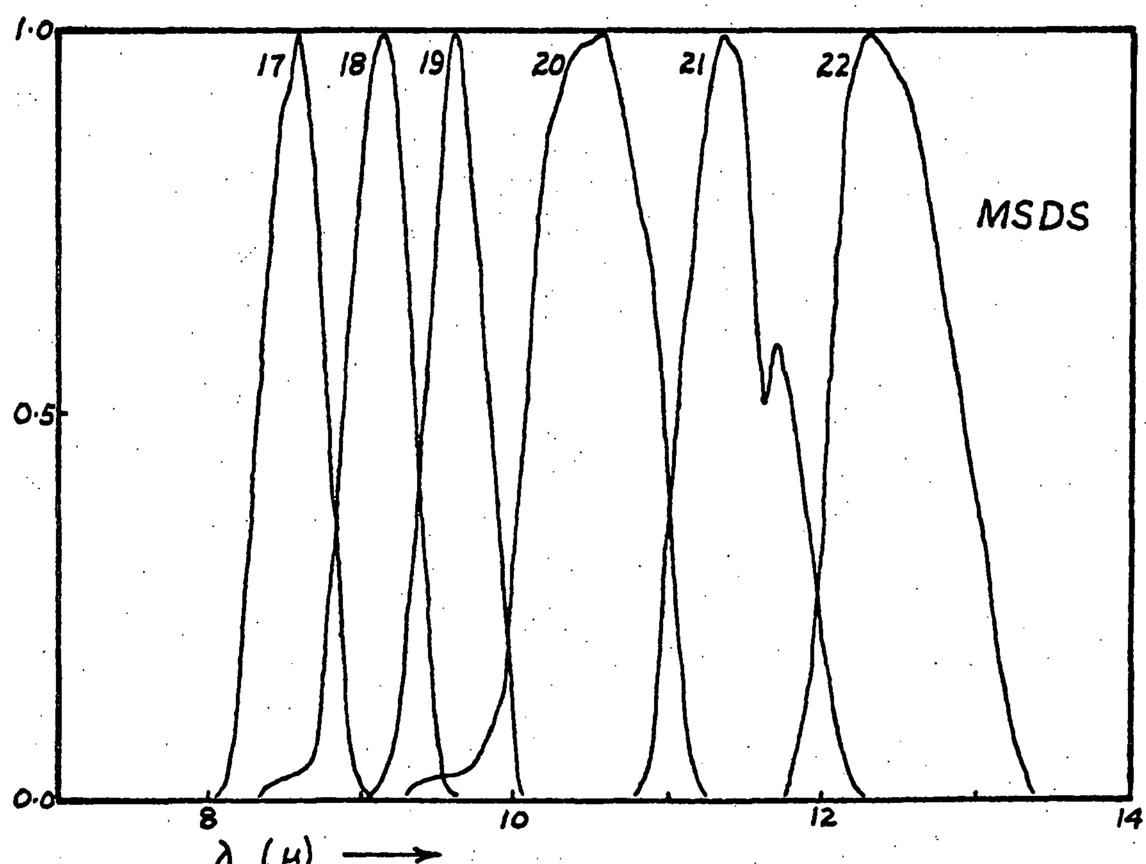


Figure I

TABLE II

FILTER TRANSMISSION FUNCTIONS

Wavelength	Channels #17	#18	#19	#20	#21	H1	H2
8.02	---	---	---	---	---	0.02	----
8.10	.20	---	---	---	---	0.04	----
8.18	.18	---	---	---	---	0.07	----
8.26	.41	---	---	---	---	0.29	----
8.32	.57	---	---	---	---	0.55	----
8.41	.78	---	---	---	---	0.75	----
8.48	.90	---	---	---	---	0.76	----
8.56	.99	.03	---	---	---	0.76	----
8.64	.90	.03	---	---	---	0.77	----
8.72	.65	.12	---	---	---	0.80	----
8.80	.37	.36	---	---	---	0.83	----
8.88	.15	.57	---	---	---	0.82	----
8.96	.05	.75	---	---	---	0.79	----
9.04	.01	.95	.01	---	---	0.77	----
9.13	---	.99	.02	---	---	0.77	----
9.20	---	.91	.05	---	---	0.77	----
9.27	---	.73	.17	.02	---	0.65	----
9.37	---	.42	.42	.03	---	0.25	----
9.45	---	.14	.68	.03	---	0.08	----
9.53	---	.03	.96	.04	---	0.06	----
9.65	---	---	.92	.04	---	0.04	----
9.69	---	---	.83	.05	---	0.04	----
9.77	---	---	.64	.06	---	0.03	0.03
9.86	---	---	.42	.11	---	----	0.04
9.96	---	---	.22	.22	---	----	0.04
10.01	---	---	.10	.41	---	----	0.05
10.10	---	---	---	.62	---	----	0.06

TABLE II (cont'd)

FILTER TRANSMISSION FUNCTIONS

Wavelength	Channels #17	#18	#19	#20	#21	H1	H2
10.17	---	---	---	.83	---	----	0.09
10.25	---	---	---	.91	---	----	0.67
10.34	---	---	---	.97	---	----	0.74
10.42	---	---	---	.98	---	----	0.74
10.49	---	---	---	.98	---	----	0.77
10.58	---	---	---	.99	---	----	0.80
10.66	---	---	---	.92	---	----	0.84
10.74	---	---	---	.83	---	----	0.84
10.81	---	---	---	.74	.02	----	0.82
10.90	---	---	---	.66	.08	----	0.79
10.97	---	---	---	.45	.29	----	0.78
11.07	---	---	---	.18	.59	----	0.79
11.15	---	---	---	.05	.76	----	0.80
11.22	---	---	---	---	.91	----	0.65
11.30	---	---	---	---	.98	----	0.50
11.38	---	---	---	---	.97	----	0.28
11.44	---	---	---	---	.92	----	0.15
11.52	---	---	---	---	.73	----	0.10
11.60	---	---	---	---	.51	----	0.08
11.68	---	---	---	---	.59	----	0.07
11.75	---	---	---	---	.53	----	0.06
11.83	---	---	---	---	.43	----	0.05
11.89	---	---	---	---	.38	----	0.05
11.97	---	---	---	---	.26	----	0.04
12.04	---	---	---	---	.15	----	----
12.12	---	---	---	---	.07	----	----
12.19	---	---	---	---	.15	----	----
12.26	---	---	---	---	---	----	----

Table III

Instrumental Responses

	17	18	19	20	21	22	H1	H2
GROUP 1								
AVERAGES	6.43	6.60	6.05	12.35	9.76	11.59	11.84	13.12
STD.DEVS.	0.03	0.04	0.04	0.06	0.04	0.06	0.06	0.07
% ERROR	0.47	0.64	0.74	0.50	0.39	0.55	0.48	0.51
GROUP 2								
AVERAGES	6.64	6.80	6.19	12.57	9.90	11.75	12.20	13.33
STD.DEVS.	0.05	0.05	0.04	0.06	0.05	0.06	0.08	0.06
% ERROR	0.68	0.68	0.73	0.50	0.46	0.52	0.63	0.44
GROUP 3								
AVERAGES	6.57	6.71	6.18	12.70	10.05	11.94	12.06	13.49
STD.DEVS.	0.06	0.04	0.06	0.09	0.07	0.07	0.07	0.08
% ERROR	0.86	0.56	0.91	0.72	0.73	0.60	0.54	0.61
GROUP 4								
AVERAGES	6.36	6.52	6.00	12.25	9.69	11.50	11.70	13.01
STD.DEVS.	0.04	0.04	0.03	0.06	0.04	0.07	0.06	0.06
% ERROR	0.62	0.57	0.57	0.48	0.46	0.57	0.51	0.45
GROUP 5								
AVERAGES	6.81	6.95	6.29	12.71	10.01	11.89	12.49	13.47
STD.DEVS.	0.09	0.08	0.07	0.14	0.09	0.10	0.15	0.14
% ERROR	1.33	1.09	1.07	1.12	0.93	0.87	1.18	1.06
GROUP 6								
AVERAGES	7.18	7.35	6.63	13.41	10.47	12.36	13.19	14.18
STD.DEVS.	0.21	0.18	0.15	0.29	0.27	0.29	0.34	0.32
% ERROR	2.87	2.49	2.19	2.13	2.58	2.33	2.61	2.29
GROUP 7								
AVERAGES	6.84	7.01	6.33	12.76	10.01	11.88	12.58	13.50
STD.DEVS.	0.10	0.11	0.11	0.30	0.25	0.31	0.19	0.33
% ERROR	1.50	1.51	1.73	2.34	2.47	2.64	1.49	2.41
GROUP 8								
AVERAGES	7.45	7.57	6.80	13.59	10.56	12.46	13.63	14.34
STD.DEVS.	0.54	0.57	0.52	0.94	0.60	0.57	1.00	0.94
% ERROR	7.25	7.54	7.60	6.91	5.69	4.54	7.36	6.53
GROUP 9								
AVERAGES	7.74	7.89	7.11	14.28	11.10	12.90	14.19	15.06
STD.DEVS.	0.27	0.32	0.25	0.35	0.26	0.25	0.54	0.36
% ERROR	3.43	4.08	3.52	2.46	2.35	1.97	3.78	2.36
GROUP 10								
AVERAGES	7.11	7.24	6.46	12.99	10.08	11.87	13.03	13.70
STD.DEVS.	0.27	0.28	0.26	0.44	0.29	0.38	0.49	0.43
% ERROR	3.86	3.89	4.09	3.42	2.93	3.23	3.79	3.12
GROUP 11								
AVERAGES	6.82	6.97	6.23	12.53	9.83	11.64	12.51	13.26
STD.DEVS.	0.18	0.18	0.21	0.30	0.18	0.15	0.32	0.29
% ERROR	2.62	2.60	3.30	2.37	1.85	1.33	2.58	2.21
GROUP 12								
AVERAGES	7.16	7.32	6.49	13.08	10.26	12.14	13.15	13.85
STD.DEVS.	0.15	0.13	0.10	0.16	0.16	0.24	0.26	0.18
% ERROR	2.11	1.81	1.47	1.23	1.58	1.99	1.96	1.31
GROUP 13								
AVERAGES	6.78	6.92	6.20	12.45	9.72	11.57	12.44	13.15
STD.DEVS.	0.17	0.16	0.11	0.22	0.18	0.20	0.29	0.24
% ERROR	2.44	2.30	1.81	1.78	1.87	1.77	2.34	1.81
GROUP 14								
AVERAGES	7.15	7.26	6.48	13.05	10.21	12.13	13.08	13.79
STD.DEVS.	0.26	0.22	0.21	0.36	0.22	0.23	0.43	0.34
% ERROR	3.68	3.06	3.19	2.75	2.15	1.86	3.27	2.45

Table III (cont)

	17	18	19	20	21	22	H1	H2
GROUP 15								
AVERAGES	6.86	6.98	6.24	12.60	9.84	11.69	12.56	13.31
STD.DEVS.	0.10	0.10	0.06	0.14	0.12	0.18	0.16	0.16
% ERROR	1.41	1.37	1.04	1.14	1.21	1.51	1.30	1.20
GROUP 16								
AVERAGES	6.76	6.89	6.19	12.37	9.71	11.58	12.39	13.07
STD.DEVS.	0.12	0.10	0.11	0.19	0.13	0.12	0.20	0.17
% ERROR	1.72	1.50	1.72	1.50	1.32	1.00	1.58	1.33
GROUP 17								
AVERAGES	7.16	7.28	6.49	13.08	10.22	12.11	13.11	13.82
STD.DEVS.	0.13	0.14	0.13	0.24	0.12	0.11	0.23	0.21
% ERROR	1.79	1.94	2.04	1.81	1.18	0.89	1.77	1.53
GROUP 18								
AVERAGES	6.72	6.86	6.14	12.42	9.77	11.63	12.32	13.15
STD.DEVS.	0.12	0.14	0.12	0.20	0.10	0.11	0.24	0.18
% ERROR	1.82	2.06	1.89	1.58	0.98	0.93	1.95	1.38
GROUP 19								
AVERAGES	6.90	7.03	6.28	12.63	9.91	11.79	12.64	13.35
STD.DEVS.	0.13	0.15	0.14	0.20	0.15	0.17	0.24	0.20
% ERROR	1.90	2.12	2.15	1.61	1.51	1.47	1.93	1.48
GROUP 20								
AVERAGES	6.69	6.84	6.12	12.37	9.71	11.55	12.28	13.10
STD.DEVS.	0.10	0.09	0.08	0.16	0.10	0.12	0.16	0.16
% ERROR	1.45	1.34	1.35	1.31	1.07	1.00	1.30	1.20
GROUP 21								
AVERAGES	6.90	7.01	6.24	12.60	9.85	11.73	12.63	13.32
STD.DEVS.	0.10	0.10	0.11	0.20	0.14	0.14	0.18	0.20
% ERROR	1.50	1.49	1.76	1.58	1.39	1.17	1.39	1.52
GROUP 22								
AVERAGES	6.57	6.75	6.13	12.45	9.82	11.66	12.09	13.21
STD.DEVS.	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.06
% ERROR	0.74	0.75	0.84	0.40	0.53	0.54	0.61	0.42
GROUP 23								
AVERAGES	6.78	6.94	6.21	12.48	9.81	11.70	12.45	13.22
STD.DEVS.	0.08	0.10	0.09	0.15	0.12	0.11	0.16	0.16
% ERROR	1.13	1.50	1.53	1.20	1.22	0.98	1.25	1.17
GROUP 24								
AVERAGES	6.51	6.65	5.94	12.07	9.52	11.38	11.94	12.81
STD.DEVS.	0.13	0.12	0.09	0.18	0.09	0.12	0.21	0.16
% ERROR	1.96	1.73	1.47	1.46	0.96	1.04	1.80	1.28
GROUP 25								
AVERAGES	6.81	6.96	6.20	12.54	9.83	11.70	12.51	13.27
STD.DEVS.	0.17	0.18	0.14	0.29	0.19	0.17	0.32	0.29
% ERROR	2.51	2.66	2.25	2.29	1.96	1.43	2.54	2.15
GROUP 26								
AVERAGES	6.80	6.97	6.24	12.55	9.85	11.74	12.50	13.27
STD.DEVS.	0.09	0.09	0.06	0.13	0.08	0.12	0.15	0.13
% ERROR	1.37	1.25	0.98	1.01	0.83	0.98	1.24	0.97
GROUP 27								
AVERAGES	6.58	6.74	6.03	12.21	9.63	11.48	12.09	12.95
STD.DEVS.	0.09	0.08	0.13	0.12	0.06	0.07	0.11	0.10
% ERROR	1.36	1.13	2.12	0.96	0.67	0.59	0.88	0.79

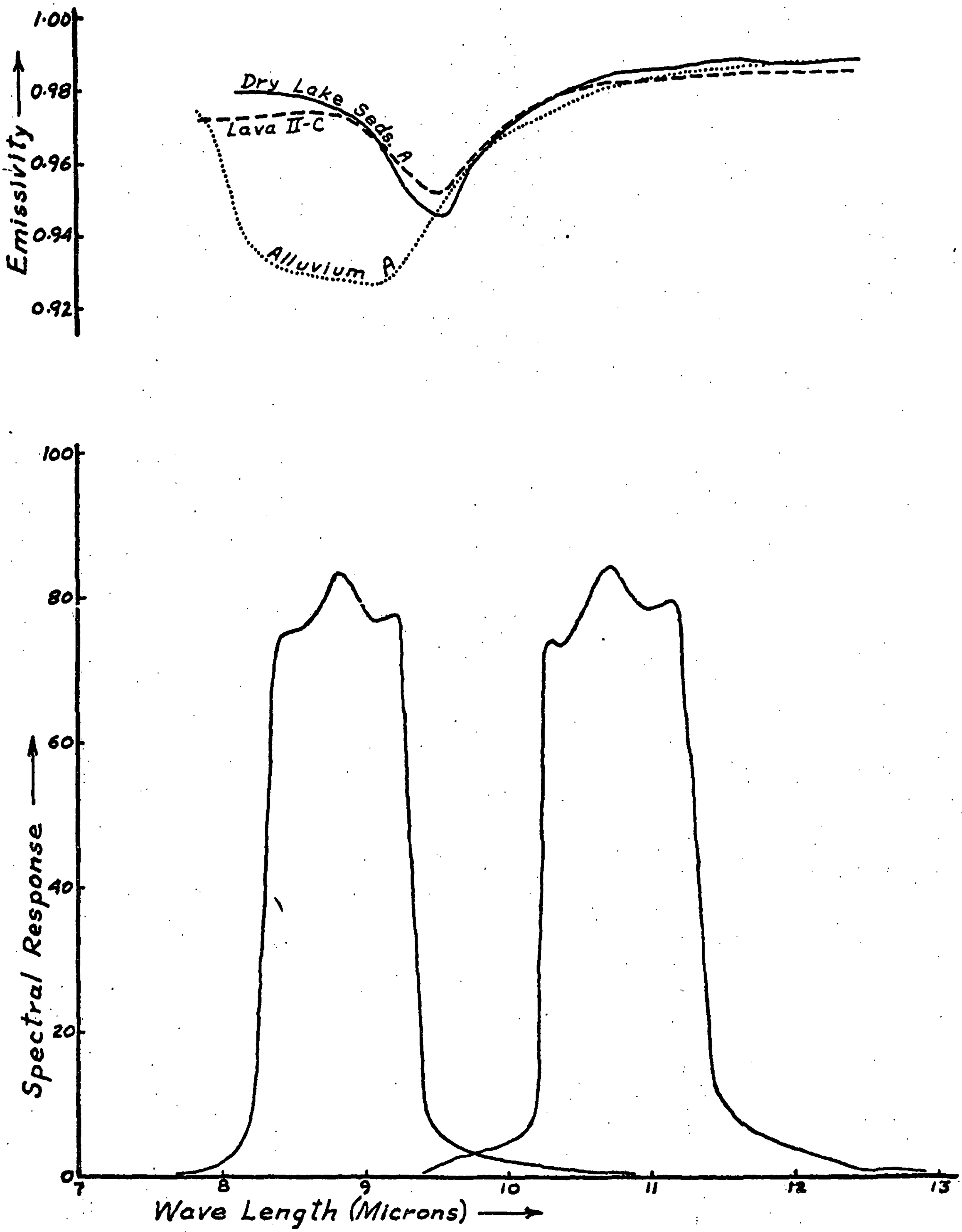
Table III (cont)

	17	18	19	20	21	22	H1	H2
GROUP 28								
AVERAGES	6.70	6.80	6.04	12.35	9.74	11.59	12.26	13.11
STD.DEVS.	0.07	0.10	0.14	0.11	0.06	0.09	0.11	0.09
% ERROR	1.00	1.41	2.31	0.86	0.67	0.74	0.88	0.69
GROUP 29								
AVERAGES	6.65	6.83	6.14	12.40	9.73	11.57	12.24	13.13
STD.DEVS.	0.08	0.08	0.09	0.15	0.10	0.16	0.13	0.15
% ERROR	1.27	1.18	1.41	1.24	1.07	1.39	1.08	1.15
GROUP 30								
AVERAGES	6.86	7.00	6.33	12.85	10.12	12.00	12.58	13.62
STD.DEVS.	0.05	0.04	0.04	0.06	0.05	0.06	0.06	0.06
% ERROR	0.66	0.57	0.66	0.46	0.50	0.48	0.51	0.44
GROUP 31								
AVERAGES	6.86	7.00	6.33	12.84	10.11	11.98	12.58	13.61
STD.DEVS.	0.05	0.06	0.04	0.08	0.06	0.08	0.10	0.08
% ERROR	0.79	0.81	0.67	0.62	0.63	0.65	0.76	0.59
GROUP 40								
AVERAGES	7.13	7.29	6.51	13.07	10.21	12.09	13.09	13.81
STD.DEVS.	0.16	0.16	0.12	0.25	0.20	0.25	0.28	0.27
% ERROR	2.24	2.15	1.88	1.93	2.00	2.05	2.18	1.95
GROUP 41								
AVERAGES	7.08	7.25	6.49	13.03	10.18	12.08	13.00	13.76
STD.DEVS.	0.19	0.17	0.13	0.26	0.19	0.23	0.33	0.27
% ERROR	2.70	2.38	2.06	1.98	1.88	1.90	2.50	1.93
GROUP 42								
AVERAGES	6.87	7.01	6.25	12.57	9.85	11.73	12.59	13.30
STD.DEVS.	0.19	0.17	0.16	0.30	0.24	0.26	0.32	0.32
% ERROR	2.73	2.48	2.57	2.42	2.43	2.25	2.58	2.43
GROUP 43								
AVERAGES	7.40	7.53	6.74	13.44	10.43	12.36	13.55	14.16
STD.DEVS.	0.24	0.22	0.21	0.42	0.28	0.31	0.41	0.41
% ERROR	3.24	2.89	3.13	3.15	2.67	2.49	3.03	2.90
GROUP 44								
AVERAGES	6.96	7.13	6.39	12.72	9.93	11.76	12.78	13.43
STD.DEVS.	0.11	0.08	0.14	0.20	0.16	0.14	0.16	0.20
% ERROR	1.59	1.18	2.14	1.56	1.64	1.17	1.28	1.49
GROUP 45								
AVERAGES	6.83	7.01	6.29	12.51	9.87	11.86	12.56	13.24
STD.DEVS.	0.30	0.23	0.17	0.32	0.25	0.38	0.47	0.33
% ERROR	4.39	3.31	2.71	2.56	2.50	3.25	3.72	2.47
GROUP 46								
AVERAGES	7.12	7.31	6.56	13.05	10.18	12.14	13.10	13.77
STD.DEVS.	0.31	0.23	0.16	0.35	0.28	0.32	0.48	0.39
% ERROR	4.35	3.09	2.47	2.69	2.77	2.61	3.67	2.84
GROUP 53								
AVERAGES	5.75	5.96	5.41	10.89	8.62	10.33	10.62	11.56
STD.DEVS.	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05
% ERROR	0.51	0.52	0.52	0.39	0.46	0.49	0.47	0.40
GROUP 54								
AVERAGES	6.75	6.89	6.18	12.47	9.78	11.64	12.38	13.19
STD.DEVS.	0.14	0.14	0.12	0.22	0.17	0.18	0.25	0.23
% ERROR	2.04	2.07	2.02	1.78	1.70	1.51	2.00	1.74

(b) Discussion

The usefulness of this type of data in rock-type discrimination is illustrated in Figures II, III, IV. In these examples three different rock types have been selected to test the ability of the system to discriminate between them. Figure II shows the spectral response of the two HRSCMR channels centered at 8.75μ and 10.75μ and the emittance curves for the three rocks (Alluvium A, Lava II-C, Dry Lake Sediments A). The curves for the lava and the dry lake sediments are very similar and in strong contrast to the alluvium.

A two-channel system of the sort considered here gives two types of information about the target (a) the apparent temperature as indicated by the absolute magnitudes of the responses in both channels and (b) the spectral structure of the silica reststrahlan band which is reflected in the relative responses in each channel. Processing techniques which produce variables like V_1/V_2 or ΔT suppress most of the temperature information leaving only the spectral information. Figure III is a plot of V_1 against V_2 and contains both temperature and spectral information, thus the lava is separated from the dry lake sediments by virtue of its lower temperature in both channels. In Figure IV most of the temperature information is suppressed and we can now only separate the samples into two groups based on the spectral information.



1.00
0.98
0.96
0.94
0.92
Emissivity
Dry Lake Seds. A
Lava II-C
Alluvium A
100
80
60
40
20
0
Spectral Response
7
8
9
10
11
12
13
Wave Length (Microns)

Figure II

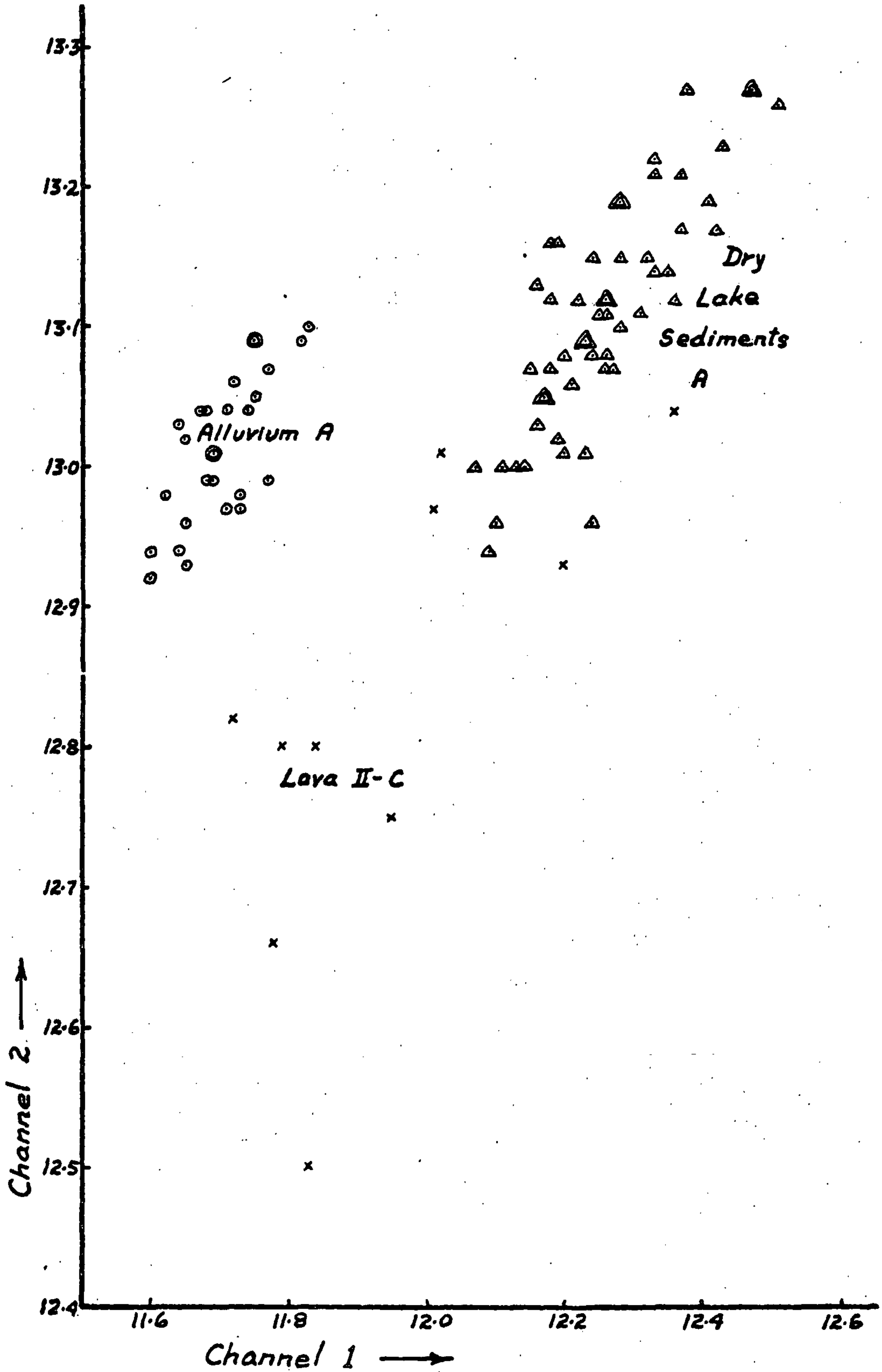

13·3
13·2
13·1
13·0
12·9
12·8
12·7
12·6
12·5
12·4
11·6
11·8
12·0
12·2
12·4
12·6
Channel 2
Channel 1
Alluvium A
Dry
Lake
Sediments
A
Lava II-C

Figure III

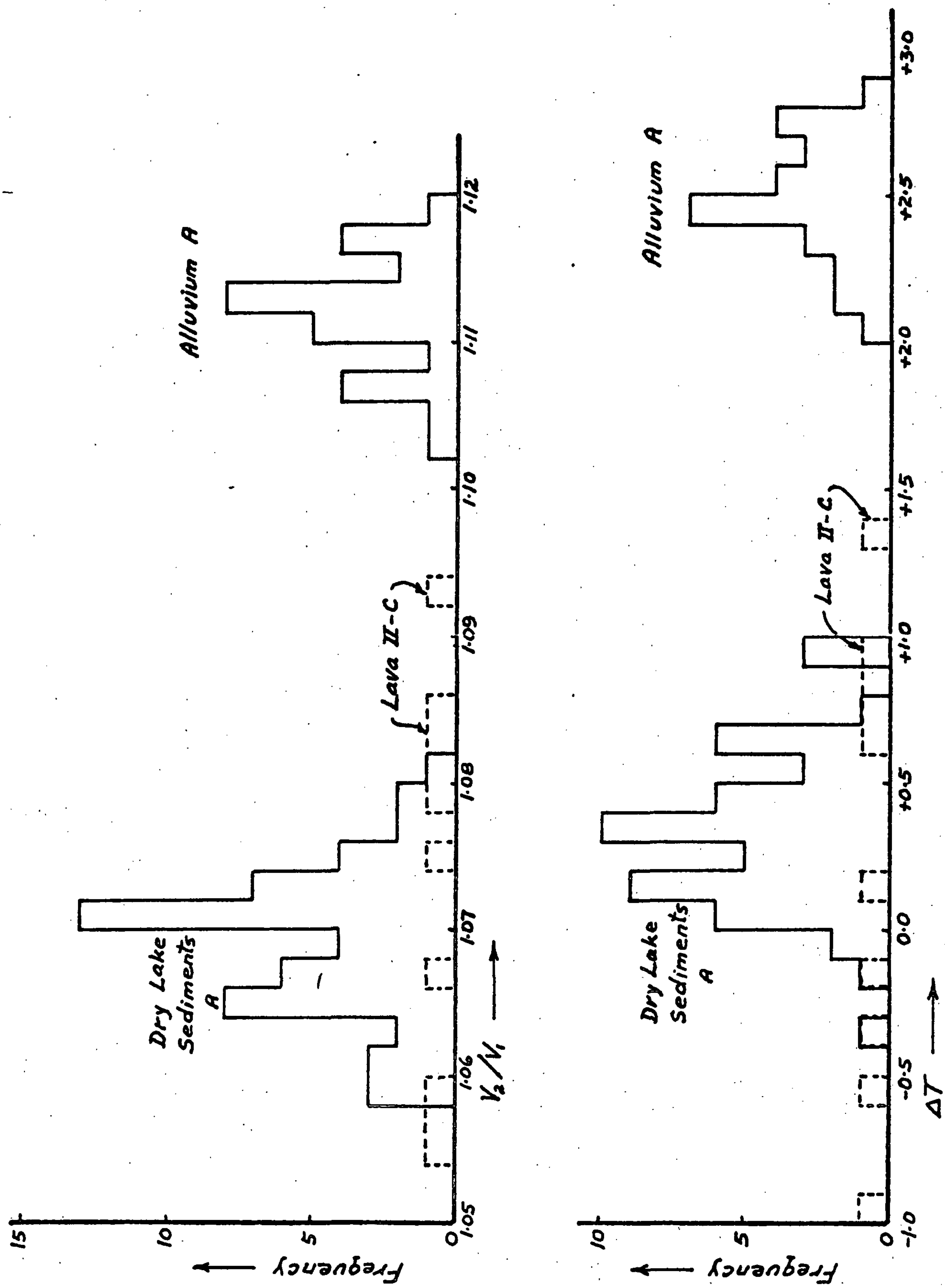

Alluvium A
Dry Lake Sediments A
Lava II-C
Frequency
15
10
5
0
1.05
1.06
1.07
1.08
1.09
1.10
1.11
1.12
V_2/V_1
Alluvium A
Dry Lake Sediments A
Lava II-C
Frequency
10
5
0
-1.0
-0.5
0.0
+0.5
+1.0
+1.5
+2.0
+2.5
+3.0
ΔT

Figure IV

TEMPERATURE EFFECTS ON V_1/V_2 AND ΔT

To test these effects we have taken the emittance curves for Alluvium A, Lava II-C and Dry Lake Sediments A, computed the response of the HRSCMR to these targets at various temperatures and then calculated the quantities V_1/V_2 and ΔT. We see from Figures V and VI that V_1/V_2 is quite a strong function of temperature for all of the rocks, and the ΔT for alluvium is also quite dependent on the surface temperature. It is apparent then, that although these quantities suppress most of the temperature effects, they do not suppress them all. Thus, from an analysis of ΔT measurements, a silicic rock will tend to look more and more silicic as its temperature goes up, while V_1/V_2 data will make it look less and less silicic. This effect may lead to differing results depending on what time of day the measurements were made. It may also lead to errors where topographic temperature variations are marked.

The temperature dependence is caused by the wavelength shift in the peak of the blackbody curve with change in temperature. The effect of the shift is easy to understand when considering the ratio because we are ratioing two quantities which are not changing at the same rate with temperature. ΔT only shows a temperature dependence when the target deviates from graybody behavior within the spectral bands of the instrument.

To try to overcome this difficulty we have developed a new variable, R, which is the ratio of the instrument response in channel 1 to the calculated response of channel 1 as if it were looking at a blackbody at temperature T_2, where T_2 is the apparent temperature indicated by channel 2. In general this quantity will be close to an emissivity for channel 1; however, even though it may be greater than 1 for rocks of low silica content, this does

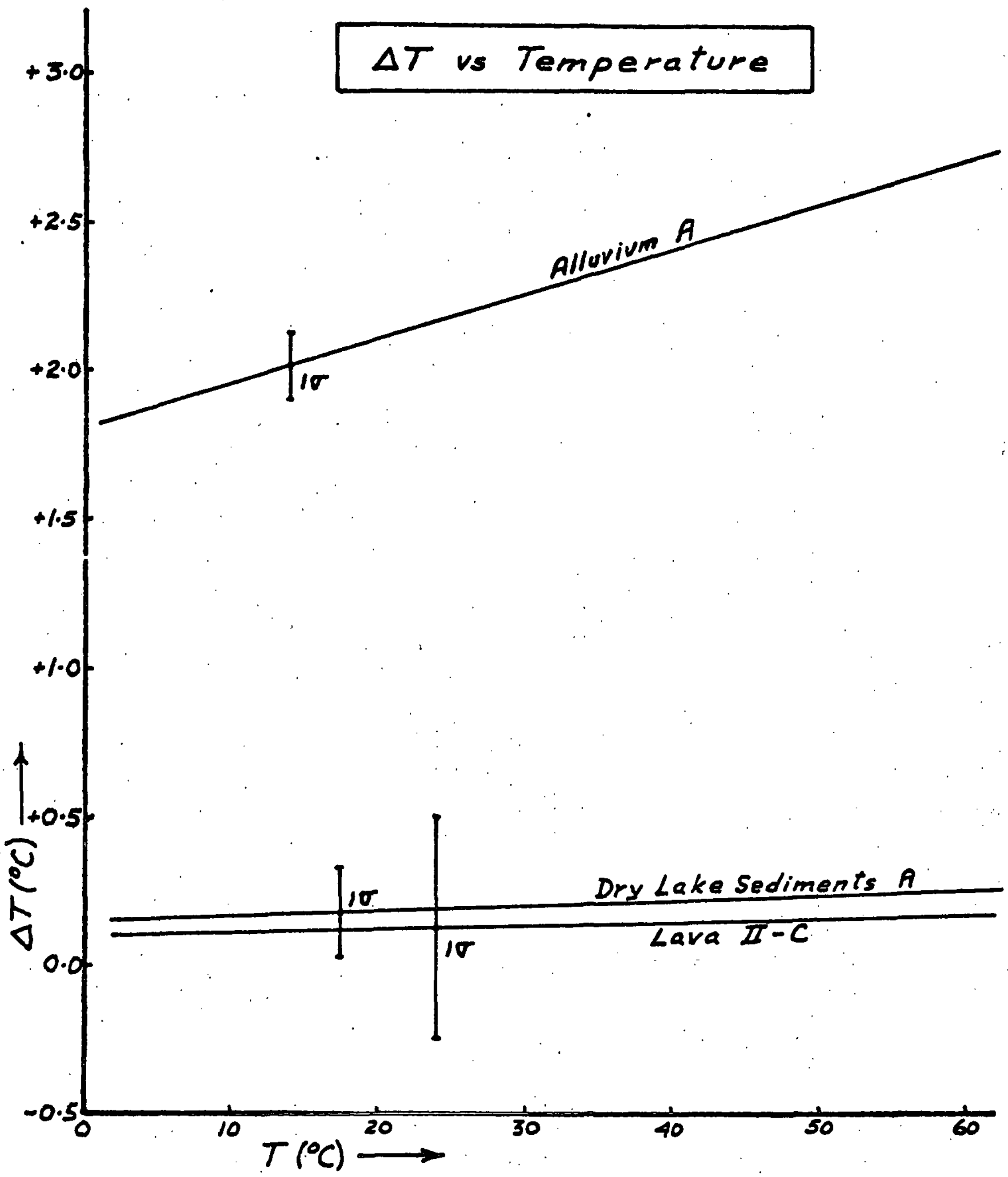

ΔT vs Temperature
+3.0
+2.5
+2.0
+1.5
+1.0
+0.5
0.0
-0.5
ΔT (°C)
Alluvium A
1σ
Dry Lake Sediments A
Lava II-C
1σ
1σ
0
10
20
30
40
50
60
T (°C)

Figure V

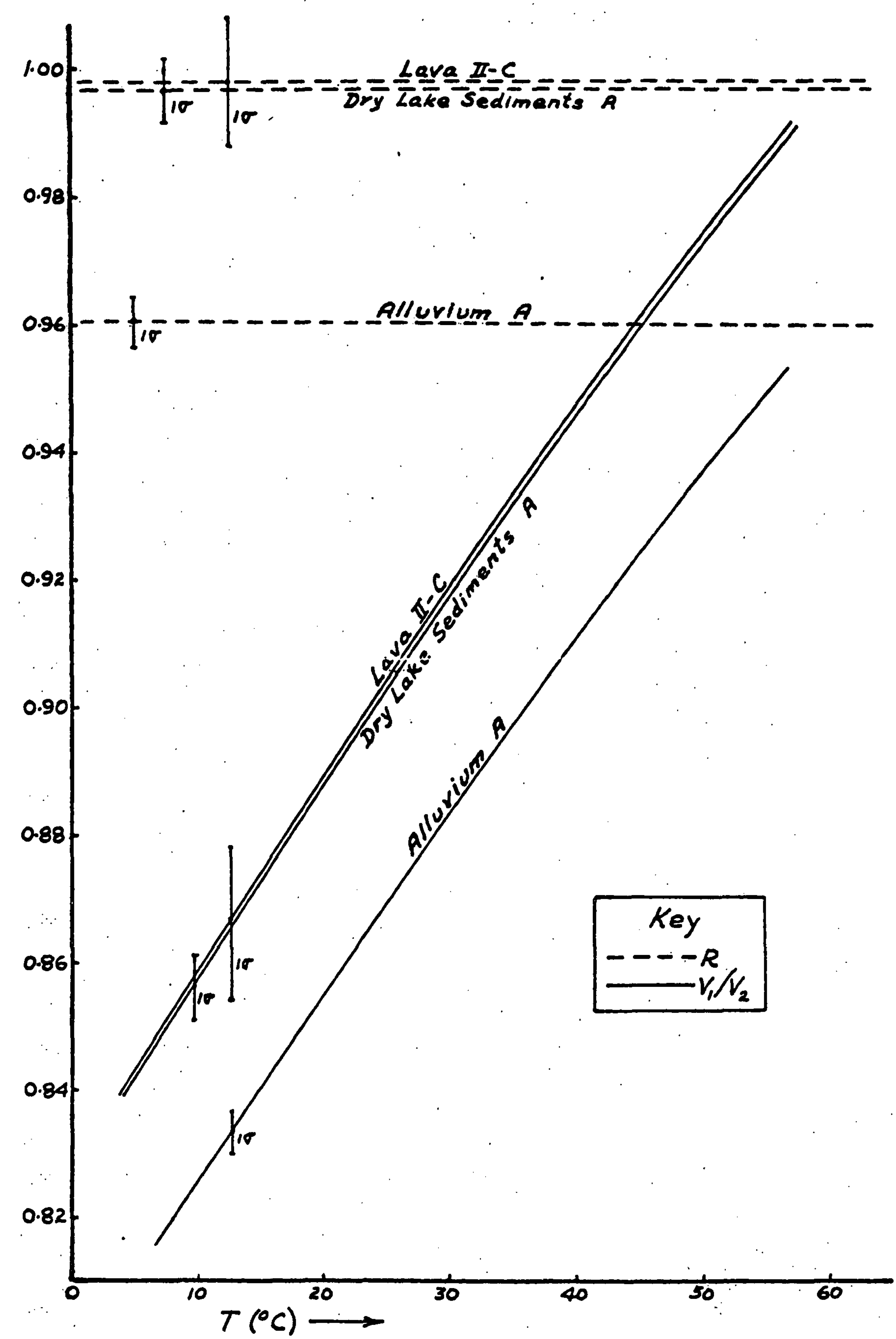

1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
0.84
0.82
0
10
20
30
40
50
60
T (°C)
Lava II-C
Dry Lake Sediments A
Alluvium A
1σ
Key
R
V₁/V₂

Figure VI

not detract from its usefulness as a discriminating variable. The calculated values for R are also shown on Figure VI and it can be seen that they are almost completely temperature independent. R values were then calculated from the instrumental responses obtained in the previous section. It can be shown that the discriminating ability is not reduced in this processing step by comparing the standard deviations of the data with the separation between the line associated with each rock type (Figures V and VI).

Suggested Data Analysis Procedure

It is required to evaluate the quantity

$$R = \frac{L_1}{L_1^B(T_2)}$$

where $L_1^B(T_2)$ is a blackbody spectral radiance in channel 1, and T_2 is the apparent temperature of the target as seen by channel 2.

From Figure VII it can be seen that there is an approximately linear relation between the blackbody spectral radiance at 8.75μ and at 10.75μ (central points for the two channels) for the range of target temperatures that might be normally expected thus.

$$L_1^B(T_2) = a\ L_2^B(T_2) + b \quad \text{where a and b are constants.}$$

Then

$$\frac{L_1}{L_1^B(T_2)} = \frac{L_1}{(a\ L_2^B(T_2) + b)}$$

Now $\tau_2\ L_2^B(T_2)$ is the radiance seen by channel 2 over any given target through an atmosphere of transmission τ_2 and likewise $\tau_1 L_1$ is the radiance seen by channel 1. From Figure VIII it can be seen that V_1 and V_2 are linear with respect to L_1^B and L_2^B thus

TABLE IV

Group	T_1		T_2		ΔT		V_1/V_2		R	
	Mean	1σ	Mean	1σ	Mean	1σ	Mean	1σ	Mean	1σ
1	32.92	0.25	35.30	0.32	2.37	0.30	0.9025	0.0045	0.9596	0.0055
2	34.65	0.34	36.43	0.29	1.78	0.22	0.9153	0.0041	0.9698	0.0045
3	34.01	0.31	37.30	0.43	3.29	0.35	0.8941	0.0047	0.9450	0.0058
4	32.24	0.28	34.73	0.28	2.48	0.21	0.8990	0.0033	0.9576	0.0041
5	36.03	0.68	37.20	0.75	1.17	0.42	0.9271	0.0062	0.9801	0.0073
6	39.24	1.58	40.90	1.65	1.65	1.76	0.9298	0.0259	0.9730	0.0286
7	36.44	0.86	37.34	1.71	0.89	1.04	0.9321	0.0123	0.9851	0.0173
8	41.12	4.45	41.65	4.78	0.56	0.72	0.9499	0.0124	0.9914	0.0117
9	43.61	2.31	45.35	1.77	1.74	0.54	0.9414	0.0133	0.9720	0.0089
10	38.51	2.25	38.41	2.24	-0.09	1.42	0.9507	0.0161	1.0019	0.0161
11	36.10	1.50	36.09	1.56	0.00-	0.43	0.9430	0.0072	1.0002	0.0075
12	39.04	1.15	39.18	0.94	0.14	0.80	0.9492	0.0128	0.9977	0.0136
13	35.76	1.36	35.48	1.27	-0.28	0.29	0.9457	0.0066	0.0050	0.0052
14	38.73	1.94	38.86	1.75	0.12	1.99	0.9481	0.0305	0.9984	0.0329
15	36.35	1.94	38.86	0.85	0.00	0.62	0.9434	0.0091	0.9999	0.0106
16	35.54	0.91	35.06	0.93	-0.47	0.55	0.9476	0.0086	1.0083	0.0096
17	38.87	1.04	39.04	1.10	0.16	0.75	0.9484	0.0112	0.9972	0.0127
18	35.22	1.12	35.49	0.97	0.27	0.51	0.9367	0.0089	0.9954	0.0088

TABLE IV (cont'd)

Group	T_1		T_2		ΔT		V_1/V_2		R	
	Mean	1σ	Mean	1σ	Mean	1σ	Mean	1σ	Mean	1σ
19	36.71	1.12	36.53	1.04	-0.17	0.83	0.9468	0.0131	0.9031	0.0142
20	35.05	0.75	35.23	0.84	0.17	0.49	0.9374	0.0074	0.9970	0.0086
21	36.67	0.81	36.38	1.07	-0.28	0.67	0.9482	0.0092	1.0050	0.0116
22	34.15	0.35	35.78	0.30	1.62	0.27	0.9158	0.0046	0.9723	0.0049
23	36.84	0.72	35.84	0.83	0.00	0.42	0.9420	0.0061	1.0000	0.0074
24	33.42	1.02	33.63	0.89	0.20	0.75	0.9323	0.0120	0.9964	0.0131
25	36.09	1.47	36.13	1.51	0.03	0.86	0.9422	0.0133	0.9995	0.0149
26	36.05	1.47	36.13	1.51	0.03	0.86	0.9415	0.0046	0.9985	0.0145
27	34.16	0.50	34.41	0.53	0.23	0.43	0.9338	0.0065	0.9956	0.0077
28	34.93	0.49	35.27	0.45	0.33	0.27	0.9349	0.0049	0.9942	0.0053
29	34.85	0.61	35.38	0.79	0.52	0.45	0.9323	0.0062	0.9910	0.0079
30	36.44	0.26	37.98	0.27	1.53	0.27	0.9236	0.0043	0.9742	0.0051
31	36.46	0.43	37.91	0.40	1.44	0.40	0.9248	0.0063	0.9750	0.0071
40	38.78	1.28	38.96	1.40	0.18	0.62	0.9478	0.0093	0.9970	0.0106
41	38.38	1.48	38.73	1.38	0.34	0.85	0.9446	0.0136	0.9942	0.0145
42	36.47	1.50	36.26	1.71	-0.20	0.73	0.9466	0.0105	1.0037	0.0127
43	40.83	1.83	40.76	2.11	-0.06	0.94	0.9569	0.0132	1.0013	0.0161
44	37.38	0.74	36.97	1.05	-0.40	0.39	0.9518	0.0040	1.0069	0.0067

TABLE IV (cont'd)

Group	T_1		T_2		ΔT		V_1/V_2		R	
	Mean	1σ	Mean	1σ	Mean	1σ	Mean	1σ	Mean	1σ
45	36.34	2.17	35.96	1.73	-0.38	2.54	0.9480	0.0382	1.0072	0.0441
46	38.79	2.20	38.75	2.05	-0.04	1.77	0.9507	0.0265	1.0011	0.0301
50	37.86	0.10	38.48	0.68	0.61	0.66	0.9397	0.0086	0.9896	0.0110
51	39.30	0.73	39.60	0.73	0.30	0.00	0.9480	0.0020	0.9950	0.0000
52	38.25	0.04	40.20	0.04	1.76	0.10	0.9260	0.0013	0.9708	0.0018
53	26.86	0.21	26.66	0.17	-0.20	0.12	0.9188	0.0031	1.0037	0.0035
54	35.49	1.15	35.72	1.22	0.22	1.06	0.9379	0.0161	0.9963	0.0184

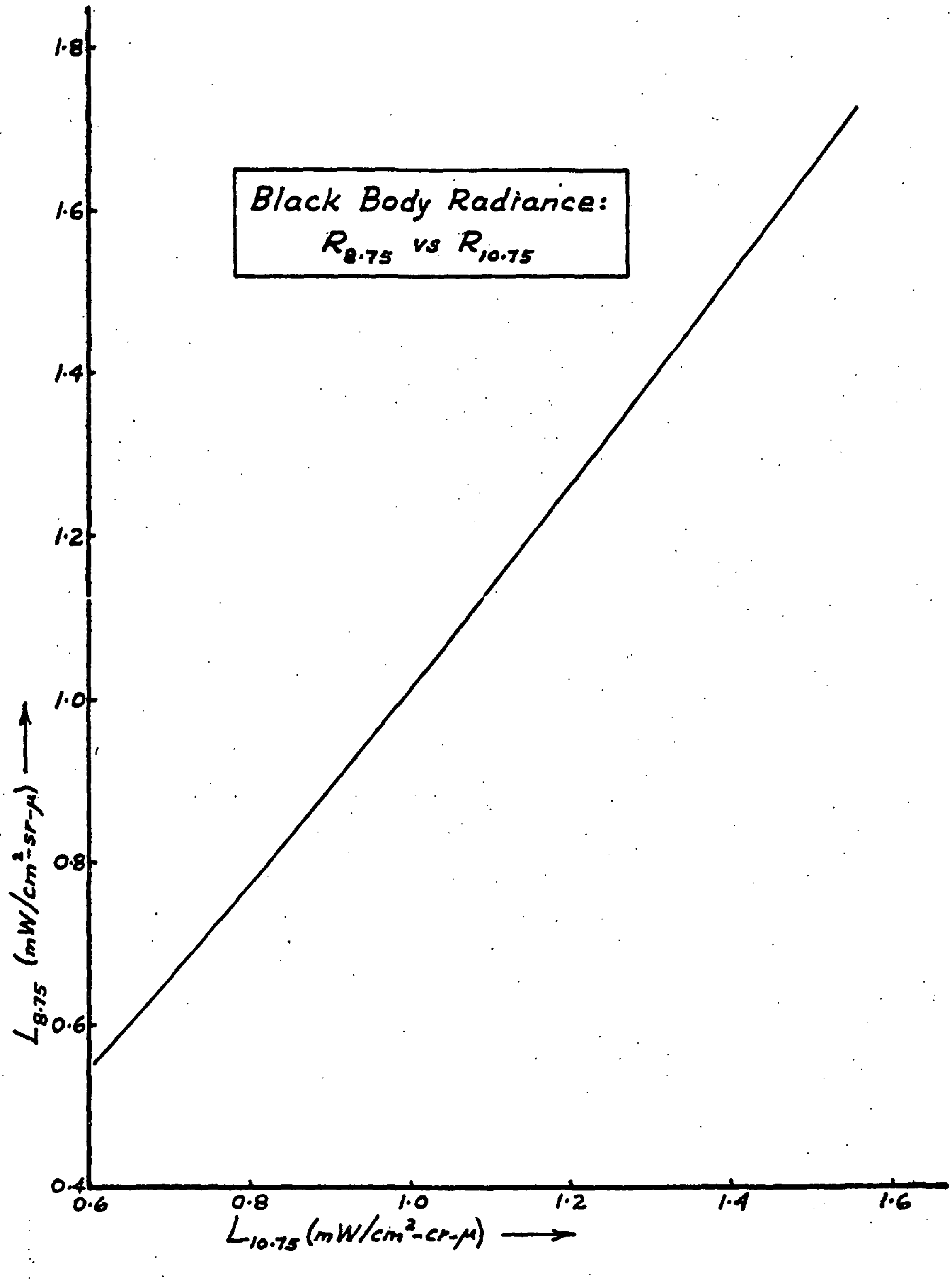

Black Body Radiance:
$R_{8.75}$ vs $R_{10.75}$
1·8
1·6
1·4
1·2
1·0
0·8
0·6
0·4
$L_{8.75}$ (mW/cm²-sr-μ)
0·6
0·8
1·0
1·2
1·4
1·6
$L_{10.75}$ (mW/cm²-cr-μ)

Figure VII

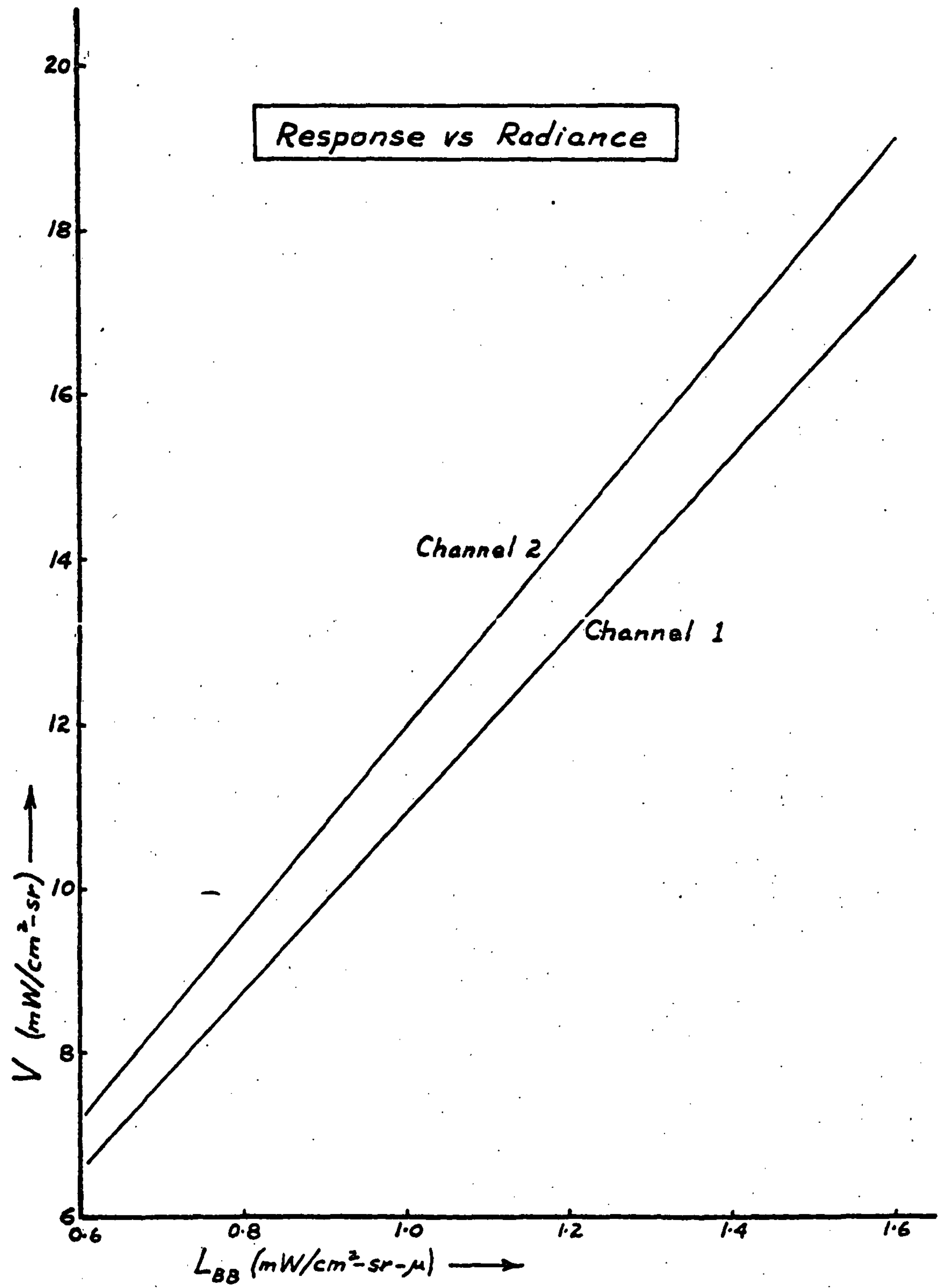

Response vs Radiance
Channel 2
Channel 1
20
18
16
14
12
10
8
6
0·6
0·8
1·0
1·2
1·4
1·6
V (mW/cm²-sr)
L_BB (mW/cm²-sr-μ)

Figure VIII

$$L_1 = \frac{c_1 V_1}{\tau_1} \qquad \text{and} \qquad L_2^{B}(T_2) = \frac{c_2 V_2}{\tau_2}$$

Substituting we get

$$R = \frac{c_1 \tau_2 V_1}{\tau_1 (a c_2 V_2 + \tau_2 b)}$$

When the system is looking at a known blackbody we know R = 1; by solving the resulting equation for $\tau_2 b$ and resubstituting into the general equation we obtain

$$R = \frac{V_1}{V_1^{B} + \left\{ \frac{\tau_1 L_2}{\tau_2 c_1} a \right\} (V_2 - V_2^{B})}$$

where V_1^{B} and V_2^{B} are the instrument responses when looking at a blackbody target through the atmosphere. The quantity

$$\left\{ \frac{\tau_2 c_2}{\tau_2 c_1} a \right\} = \beta$$

is primarily dependent on the ratio of the gains in channel 1 and channel 2. If there is any drift in c_1 and c_2 with time such that

$$\frac{c_1'}{c_1} = \alpha_1 \qquad \text{and} \qquad \frac{c_2'}{c_2} = \alpha_2$$

then the expression for R will be

$$R = \frac{V_1}{\alpha_1 V_1^{B} + \beta (V_2 - \alpha_2 V_2^{B})}$$

This correction could only be made for an instrument with onboard calibration. To determine an absolute value for R the magnitude of β must be known. This could be done in two ways; first, if another blackbody with a different temperature to that already measured to determine $\tau_2 b$ could be found producing instrumental responses V_1^{BB} and V_2^{BB}, then

$$\beta = \frac{(V_1^{BB} - V_1^{B})}{(V_2^{BB} - V_2^{B})}$$

Secondly, it should be possible to calculate β; the ratio τ_1/τ_2 should be constant for most atmospheres; a has the approximate value 1.24 and c_2/c_1 can be calculated from onboard calibration data.

If absolute measurements of R are not required, β can be given any reasonable value depending on the dynamic range of the image display; and as it is constant for any given image area, the changes in R which indicate changing silica content will still be reflected in different image density levels.

SPECIAL EMITTANCE MEASUREMENTS

The following rock spectra were measured using an EXOTECH model 10 infrared spectrometer. The instrument was calibrated using a blackbody source to determine the instrument transfer function, and the emittance curves shown were calculated assuming that at one point in the spectral range the emittance had the value of one. Wavelength calibrations were made with polystyrene.

TABLE V

DESCRIPTION OF SAMPLES USED FOR GROUND SPECTRA (Site #27)

Run	Sample Time	Mineralogy of the 1 1/2" x 1 1/2" Sample Area	Surface
1.	----- 10:40 Cinko Lake Granodiorite	The surface is coated approximately 75% by fine grained, black tourmaline crystals. The remaining lighter area is largely quartz 20% and feldspar 5%.	Rough
2.	----- 10:45 Cinko Lake Granodiorite	The sample area is approximately 30% quartz — 30% biotite, 20% feldspar mostly plagioclase, 15% hornblende 5% accessory minerals. The texture is medium-grained equigranular grano-diorite.	Polished
3.	----- 10:50 Cinko Lake Granodiorite	The 1/2" xenolith in a matrix of Cinko Lake granodiorite is composed of fine-grained biotite 80% and hornblende 20%.	Sawed
4.	----- 11:00 Cinko Lake Granodiorite	The sample is approximately the same composition as that seen in Run #2 at 10:45.	Sawed
5.	----- 11:05 Cinko Lake Granodiorite	The surface is coated approximately 50% by fine-grained, dark, tourmaline crystals. The lighter material is approximately 25% quartz and 25% feldspar.	Rough
6.	----- 11:10 Fremont Lake Granodiorite	The sample area is medium grained, equigranular, and is composed of 60% feldspar, mostly plagio-clase, 15% quartz, 10% biotite, 10% hornblende, and 5% accessory minerals.	Rough
7.	NASA #302 11:15 Cascade Creek Granite	The sample area is medium grained hypidiomorphic, and is composed of 50% quartz, 30% orthoclase, 10% biotite, 2% hornblende, some plagioclase and accessory minerals.	Rough
8.	NASA #162 11:25 Dorothy Lake Alaskite-Granite	The sample is a fine grained texture composed of 60% feldspar, 30% quartz, 2% biotite and accessory minerals.	Sawed
9.	NASA #162 11:30 Dorothy Lake Alaskite-Granite	The sample is approximately the same as Run #8 at 11:25.	Rough
10.	NASA #308 11:35 Millcreek Porphyritic Quartz Monzonite	The sample has porphyritic phenocrysts of orthoclase in a coarse grained matrix of 30% orthoclase, 20% plagioclase, 30% quartz, 10% biotite, 5% hornblende and 5% accessory minerals.	Rough

TABLE V (cont'd)

Run	Sample Time	Mineralogy of the 1 1/2" x 1 1/2" Sample Area	Surface
11.	NASA #308 11:40 Millcreek Porphyritic Quartz Monzonite	The xenolith is composed of approximately 50% biotite and 50% quartz in a very fine-grained equigranular matrix.	Rough
12.	NASA #316 11:45 Patterson Grade Granodiorite	The sample area is medium grained, equigranular and composed of 60% feldspar mostly plagioclase, 15% quartz, 15% hornblende and biotite, and 10% accessory minerals.	Rough
13.	NASA #383 11:50 Cathedral Peak Porphyritic Quartz Monzonite	The sample has orthoclase (?) phenocrysts in a coarse-grained matrix of feldspar approximately 30% orthoclase and 30% plagioclase, 30% quartz, 5% biotite and 5% accessory minerals. The surface area was moderately weathered.	Rough
14.	NASA #383 11:55	Same as above, except fresh rathered than weathered.	Rough
15.	NASA #331 12:05 Topaz Lake	1 1/2" microcline phenocryst in a matrix of Run #17, Sample #331 at 12:20.	Rough
16.	NASA #331 12:15 Topaz Lake	1 1/2" microcline phenocryst in a matrix of the below sample - NASA #331.	Rough
17.	NASA #331 12:20 Topaz Lake Porphyritic Quartz Monzonite (General pass)	The sample has microcline phenocrysts in a matrix of coarse-grained, subhedral crystals composed of 35% microcline, 30% plagioclase, 25% quartz, 4% biotite, 6% accessory minerals.	Rough
18-19-20	Calibration		
21.	NASA #621 14:50 Brown Bear Pass Basalt	Weathered surface of basalt, some hematite staining.	Rough
22.	NASA #621 15:00 Brown Bear Pass Basalt	Fresh surface is composed of 70% plagioclase feldspar, 15% augite, 5% orthoclase, 5% pyroxene and 5% magnetite weathering to hematite.	Rough
23.	Q #8 15:05 Crow Springs Porphyritic Quartz Monzonite	The sample has porphyritic phenocrysts of plagioclase 30%, and interstitial quartz 25%, orthoclase 30%, hornblende 10%, and 5% accessory minerals.	Rough
24.	Q #18 15:15 Crow Springs Quartz Monzonite Porphyry	Sample has medium-grained matrix, phenocrysts mostly well-formed plagioclase 35% up to 5mm. in in length, quartz 25%, orthoclase 30%, biotite 50%, some hornblende, and the rest accessory minerals (Dark Phase).	Sawed

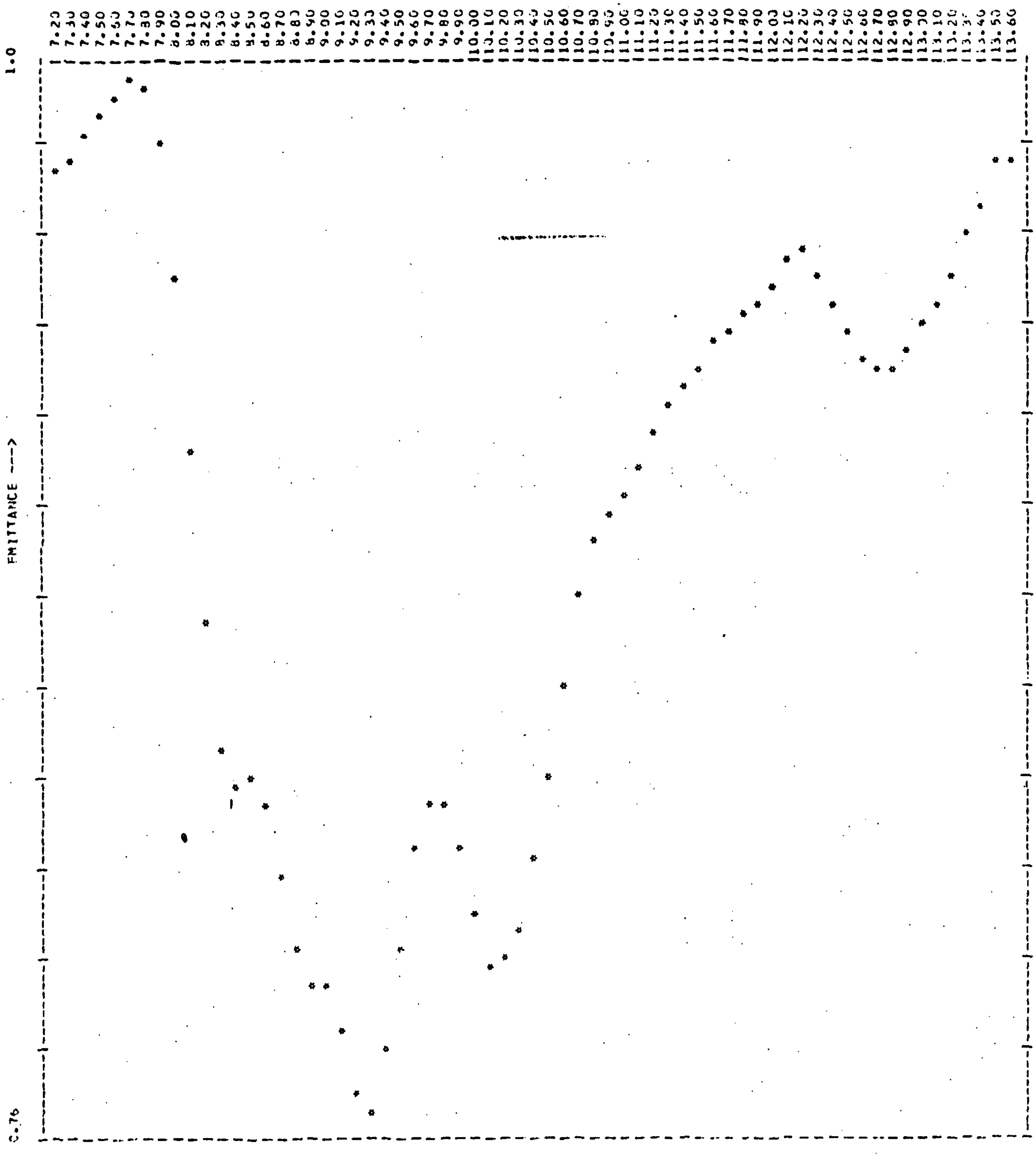
TABLE V (cont'd)

Run	Sample	Time	Mineralogy of the 1 1/2" x 1 1/2" Sample Area	Surface
25.	Q #18	15:25	Same as above Q #18 - 15:15 except it has a rough surface.	Rough
26.	Q #50 Crow Springs	15:30	Sample area strongly welded, ash flow tuff, completely devitrified, axiolitic texture, composition 60% glass and ash devitrified to cristobalite and K-feldspar. 15% subhedral quartz, 10% sanidine with trace of biotite and magnetite.	Rough
27.	Q #71 Crow Springs	15:35	Fine grained (hypocrystalline) with microlite matrix. Approximately 50% of area mostly plagioclase, larger plagioclase, subhedral to euhedral (21%), augite 8%, glass 17%.	Rough
28.	Q #71	15:40	Same as above except deeply weathered, magnetite is forming ironstain.	Rough
29.	Q #1 Crow Springs	15:45	Strongly welded quartz latite. Composition - 30% plagioclase, 10% quartz, 10% biotite, in a matrix of 50% devitrified glass.	Rough
30.	Q #61 Crow Springs	15:50	Non-welded lithic tuff. Composition - 50% volcanic dust, 14% subhedral sanidine, 12% quartz, 2% biotite, 10% pumice fragments.	Rough
31.	Q #77 Crow Springs	16:05	Weathered vitrophere, strongly welded, squashed fiamine filled with glass fragments.	Rough
32.	Q #77	16:10	Non-weathered side of the above sample.	Rough
33.	Q #63 Crow Springs	16:15	Welded quartz latite - 20% plagioclase, 15% sanidine, 10% quartz, 5% biotite, some hornblende - 10% fiamine. The matrix is composed of 40% devitrified shards. The sample is weathered.	Rough
34.	Q #63 Crow Springs	16:20	Approximately the same as above except the sample is fresh rather than weathered.	Rough
35.	Q #56 Crow Springs	16:25	Strongly altered obsidian or welded tuff - strongly devitrified 40% glass, 25% cristobalite, 20% sericite (?), 10% feldspar, 5% quartz.	Rough
36.	Q #58 Crow Springs	16:35	Strongly welded crystal tuff. 15% sanidine, 10% quartz, 10% fiamine. The matrix is composed of 60% glass shards which have been devitrified.	Rough
37.	Q #58	16:40	Same as above except for sawed surface.	Sawed
38.	Q #70 Crow Springs	16:45	Strongly welded ash flow tuff - 5% plagioclase, 5% sanidine, 2% quartz, 20% lithic fragments, 68% severely welded glass shards - reddish brown, devitrified to cristobalite and K-feldspar - a weathered sample.	Rough

Run	Sample	Time	Mineralogy of the 1 1/2" x 1 1/2" Sample Area	Surface
39.	Q #70 Crow Springs	16:55	A non-weathered sample of the above ash flow tuff.	Rough
40.			No sample.	
41.	Q #20 Crow Springs	17:45	A weathered surface of light brown chert from the Excelsior Formation, almost pure SiO_2 coated by FeOH.	Rough
42.	Q #55a Crow Springs	17:50	Welded crystal lithic tuff - crystals are 15% plagioclase, 10% quartz, 10% sanidine, 5% biotite, some lithic fragments. The remainder of the sample is 50% matrix composed of devitrified glass shards. The surface was weathered but fresh looking except for some iron staining after magnetite.	Rough
43.	#55a	18:00	Same as above except fresh and sawed.	Sawed
44.	Q #51 Crow Springs	18:10	A fresh surface of Perlite (S_iO_2, H_2O)	Rough
45.	Q #51 Crow Springs	18:15	A fresh surface of Perlite with obsidian inclusions.	Rough
46.	Q #51 Crow Springs	18:20	Spheralite in a matrix of Perlite. The composition of the spheralite is mostly cristobalite.	Rough
47.	Q #72 Crow Springs	18:25	Strongly welded lithic tuff, 75% of the sample area is composed of matrix material which is reddish-brown, devitrified, flattened, glass shards, 10% fiamine, 5% lithic fragments, 10% plagioclase.	Sawed
48.	Q #72	18:35	Most of the same products as above, but looking down on the top of the fragment - as looking down the axis of a crystal. The sample area is also strongly weathered to FeOH after magnetite.	Rough
49.	NASA 489 Sonora Pass	18:45	A calc-silicate (freshly broken) looking perpendicular to the relic bedding. Almost complete replacement by silica.	Rough
50.	Q #78 Crow Springs	18:50	Vitrophere - strongly welded, partially devitrified. 60% of sample area is glass matrix. Crystals: 5% quartz, 10% feldspar, 2% biotite, 1% hornblende, trace of magnetite.	Rough
51.	Q #53 Crow Springs	9:35	Iron-stained, weathered surface of a welded ash flow tuff. Matrix is 80% light-brown to dark-brown glass shards. Crystals: 10% plagioclase, 80% fiamine.	Rough

Run	Sample	Time	Mineralogy of the 1 1/2" x 1 1/2" Sample Area	Surface
52.	Q #52 Crow Springs	9:40	Strongly welded vitrophere. Approximately 10% fiamine in matrix of 60% glass shards. Crystals are 20% plagioclase, 5% augite, 5% magnetite.	Rough
53.	Q #55b Crow Springs	9:45	Crystal lithic quartz latite. 50% of the sample area is matrix composed of glass shards partly devitrified. Crystals: 15% plagioclase, 12% sanidine, 10% quartz, 5% biotite, 6% fiamine.	Rough
54.	Q #55b Crow Springs	9:50	Same as above but weathered surface does not show crystal faces.	Rough
55.	Q #13 Crow Springs	10:05	Crystal lithic quartz latite. Matrix comprises 70% of sample which is devitrified glass shards and fiamine crystals, 15% quartz, 10% plagioclase, 2 1/2% sanidine, 2 1/2% biotite, hematite.	Sawed
56.	Q #13 Crow Springs	10:10	Same as above, but weathered. Good crystal faces in spite of hematite staining.	Rough
57.	Q #86 Crow Springs	10:20	Strongly welded biotite quartz latite. The matrix comprises about 50% of the sample area and is composed of devitrified shards, most of which have been altered potash feldspar. Crystals are 30% plagioclase, 10% quartz, 7% biotite, 3% magnetite.	Rough
58.	Q #74 Crow Springs	10:25	Pumice or ash fall material, not welded, 70% angular glass fragments, 5% lithic fragments. Matrix: 20% brownish volcanic dust, extremely fine. Minor crystals of quartz 2%, plagioclase 2%, sanidine 1%, traces of biotite, hornblende, pyroxene.	Rough
59.	Q #91 Crow Springs	10:35	Crystal lithic quartz latite, strongly welded devitrified matrix which comprises 60% sample area. Crystals: 20% plagioclase, 10% sanidine, 5% quartz, 2% hornblende, 2% biotite.	Rough
60.	Q #17 Crow Springs	10:40	The sample is a very basic rock, either a basalt or andesite composed primarily of plagioclase 70%, clinopyroxene 20% and magnetite 7% with 3% accessory minerals. The pyroxene occurs as phenocrysts up to 1/4" in diameter. Most of the weathering products are hematite after magnetite.	Rough
61.	Q #65 Crow Springs	10:50	Basaltic andesite. Matrix is 60% microlite of plagioclase, 20% plagioclase phenocryst, 10% clinopyroxene (augite?) 10% magnetite - good fresh surface, little attrition, no weathering.	Rough

Run	Sample	Time	Mineralogy of the 1 1/2" x 1 1/2" Sample Area	Surface
62.	Q #115 Crow Springs	10:55	Strongly welded devitrified ash flow tuff. Matrix is 70% glass shards, most of which have been devitrified to cristobalite and K-feldspar. Crystals are 10% plagioclase and some magnetite, 10% fiamine, some lithic fragments.	Rough
63.	Q #99 Crow Springs	11:05	Welded fine grained vitric tuff, weathered red-orange in color due to magnetite alteration. Matrix 80% glass shards, some fiamine devitrified to cristobalite and K-feldspar. Crystals are 10% sanidine, 5% plagioclase and 5% magnetite.	Rough
64.	Q #68 Crow Springs	11:15	Basaltic andesite - 55% plagioclase as small laths, 20% magnetite plus hematite, 5% pyroxene, 5% olivine, 15% glass intersectal in the matrix, strongly flow banded.	Sawed
65.	Bad run ?			
66.	Q #64 Crow Springs	11:35	Andesite basalt. The matrix is 70% microlite of plagioclase magnetite and (?). Phenocryst of plagioclase 20%, pyroxene 5% and magnetite plus hematite 5%.	Rough
67.	----- Sonora Pass	11:45	Massive - white, bull quartz.	Rough
68.	-----	1205	Mono Lake Black Pumice	
69	-----	1210	Mono Lake Grey Pumice	



72 07 17 1040 [illegible] LAKE [illegible] SHOWING MUCH TOURMALINE ROUGH SURFAC
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WAVELENGTH OF EMIT. MAX.= 7.66
TARGET TEMPERATURE (SPECT-[illegible]) 35.57
EMITTANCES AT SPECIFIC WAVELENGTHS

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8.000 0.9[illegible]3	8.100 0.91[illegible]	[illegible] 0.875	[illegible]	[illegible] 0.841	8.500 0.844	8.600 0.836	8.700 0.821
8.800 0.80[illegible]	8.900 0.79[illegible]	9.000 0.7[illegible]	9.100 0.788	9.200 0.773	9.300 0.769	9.400 0.783	9.500 0.805
9.600 0.82[illegible]	9.700 [illegible]	9.800 0.837	9.900 0.826	10.000 0.813	10.100 0.802	10.200 0.802	10.300 0.810
10.400 0.825	10.500 0.846	10.600 0.864	10.700 0.882	10.800 0.895	10.900 0.901	11.000 0.906	11.100 0.912
11.200 0.919	11.300 0.925	11.400 0.930	11.500 0.934	11.600 0.938	11.700 0.942	11.800 0.945	11.900 0.947
12.000 0.950	12.100 0.956	12.200 0.959	12.300 0.954	12.400 0.947	12.500 0.940	12.600 0.935	12.700 0.934
12.800 0.936	12.900 0.94[illegible]	13.000 0.943	13.100 0.947	13.200 0.954	13.300 0.963	13.400 0.969	13.500 0.978
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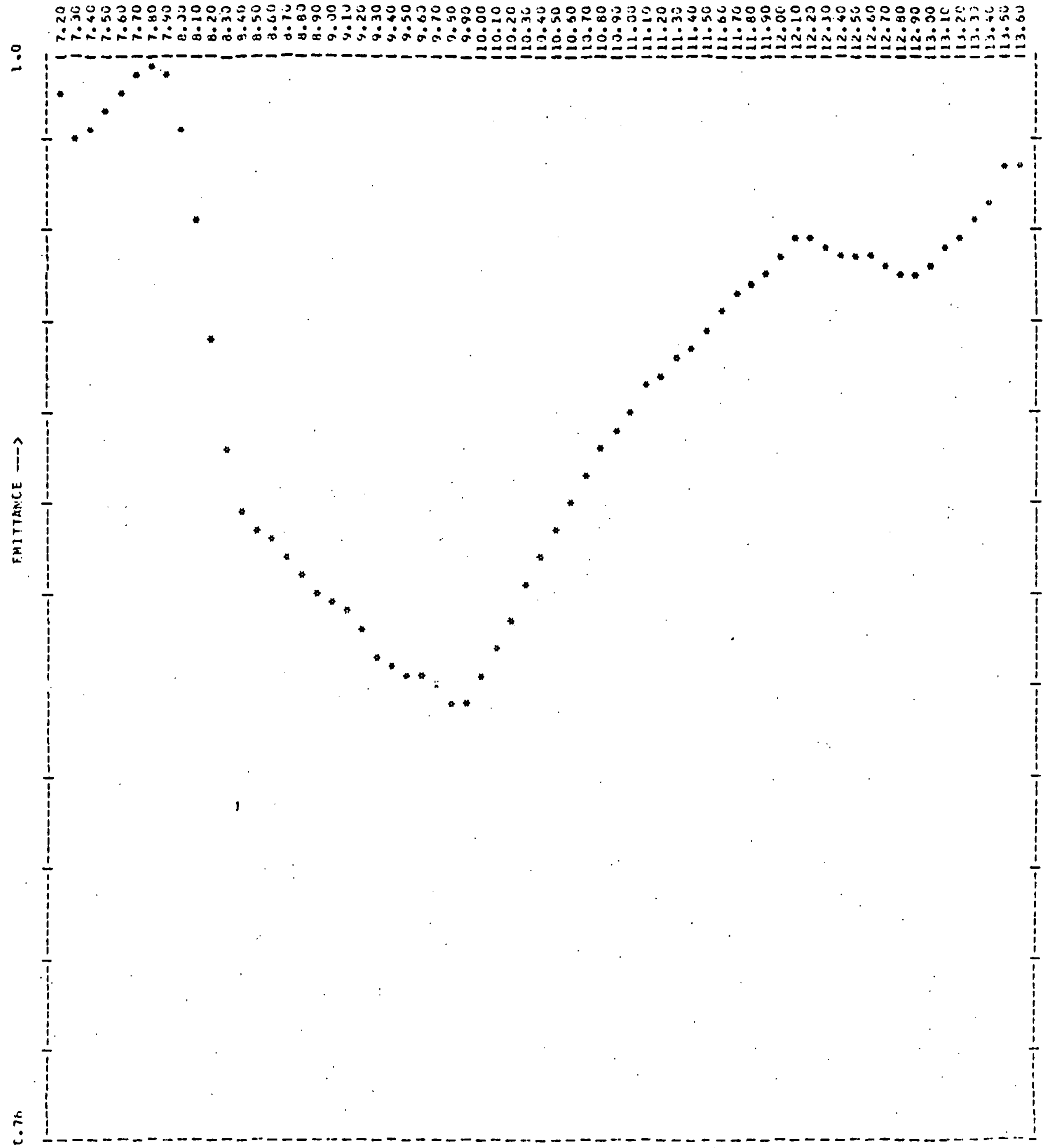

72 07 17 1045 [illegible] POLISHED
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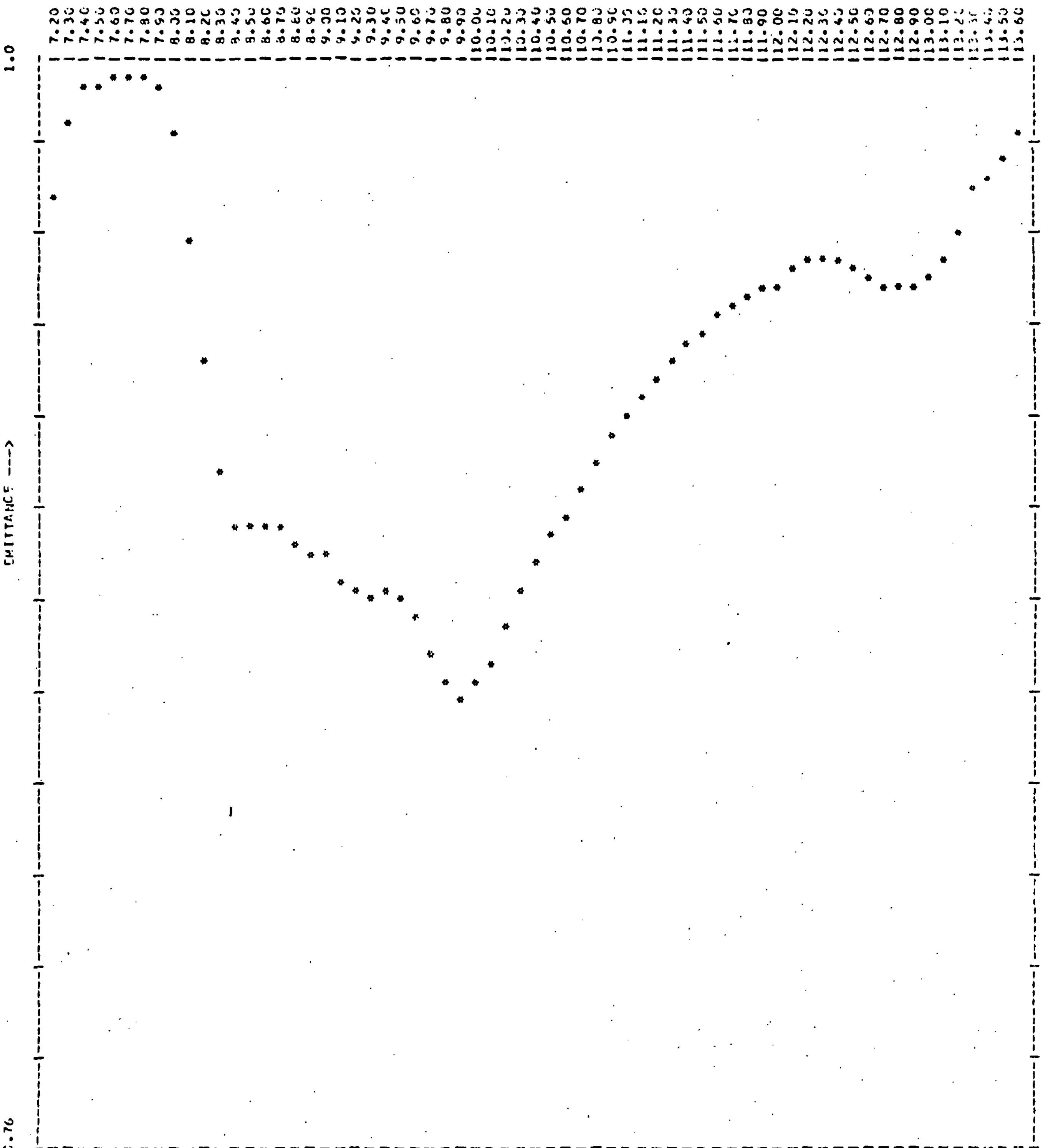
WAVELENGTH OF EMIT. MAX.= 7.69
TARGET TEMPERATURE (SPECTROMETER) = 35.5[illegible]
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 [illegible]	7.300 [illegible]	7.400 0.985	7.500 [illegible]	7.600 [illegible]	7.700 0.997	7.800 0.999	7.900 0.996
8.000 [illegible]	8.100 [illegible]	8.200 [illegible]	8.300 0.916	8.400 [illegible]	8.500 0.897	8.600 0.895	8.700 0.891
8.800 0.886	8.900 0.882	9.000 0.881	9.100 0.878	9.200 0.876	9.300 0.869	9.400 0.867	9.500 0.866
9.600 0.865	9.700 [illegible]	9.800 0.860	9.900 [illegible]	10.000 [illegible]	10.100 0.871	10.200 0.878	10.300 0.884
10.400 0.891	10.500 [illegible]	10.600 0.904	10.700 0.910	10.800 0.916	10.900 0.920	11.000 0.924	11.100 0.928
11.200 0.932	11.300 [illegible]	11.400 0.938	11.500 0.942	11.600 0.946	11.700 0.949	11.800 0.951	11.900 0.953
12.000 0.957	12.100 0.960	12.200 0.961	12.300 0.959	12.400 0.957	12.500 0.957	12.600 0.956	12.700 0.954
12.800 0.953	12.900 0.953	13.000 0.956	13.100 [illegible]	13.200 0.961	13.300 0.966	13.400 0.970	13.500 0.977
13.600 0.977							

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72 07 17   1050        CINKO LAKE GRANODIORITE  XENOLITH  SHOWING BIOTITE (80 %)
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WAVELENGTH OF EMIT. MAX.=  7.57
TARGET TEMPERATURE (SPECTROMETRIC) =  28.25
EMITTANCES AT SPECIFIC WAVELENGTHS
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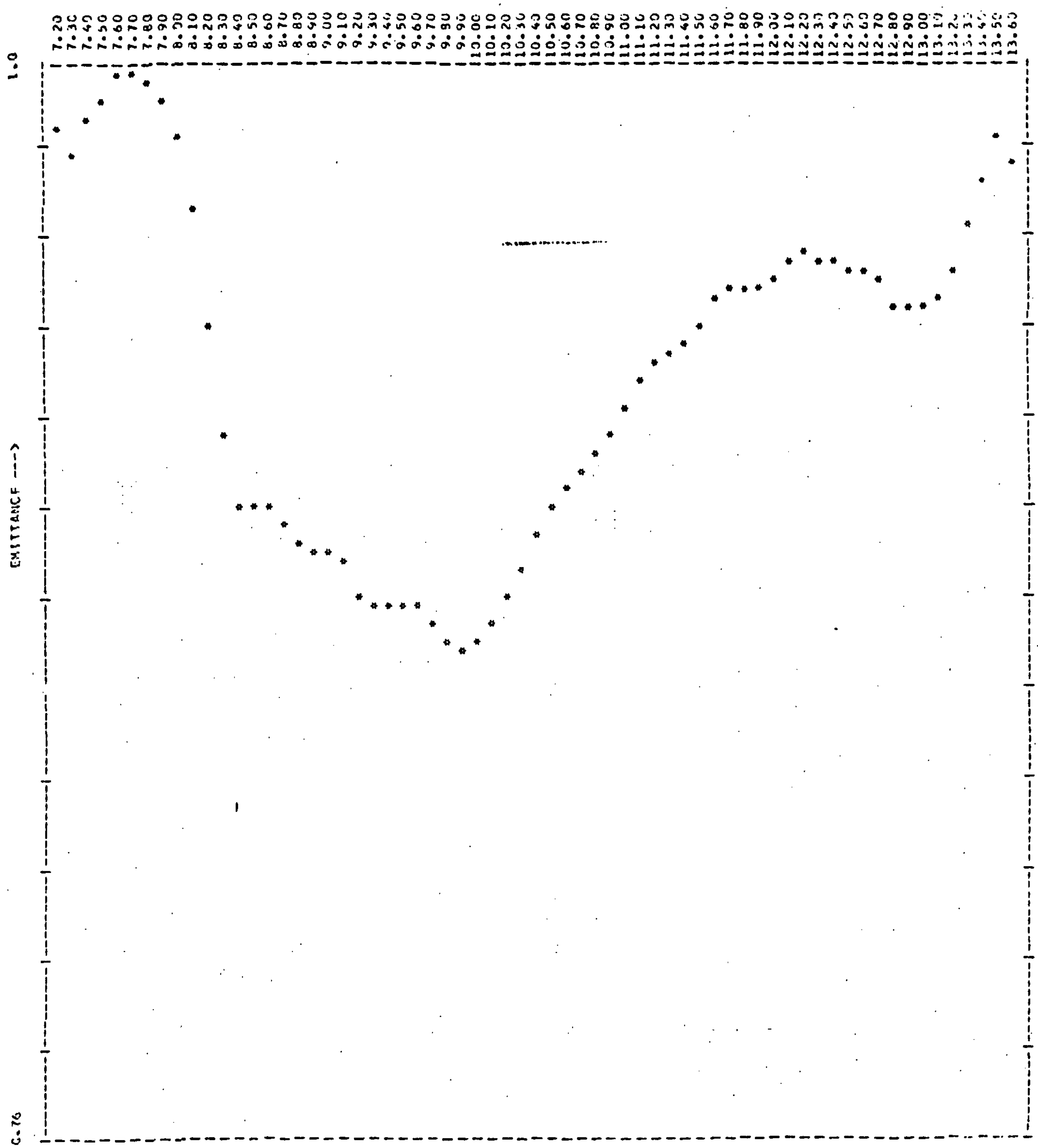
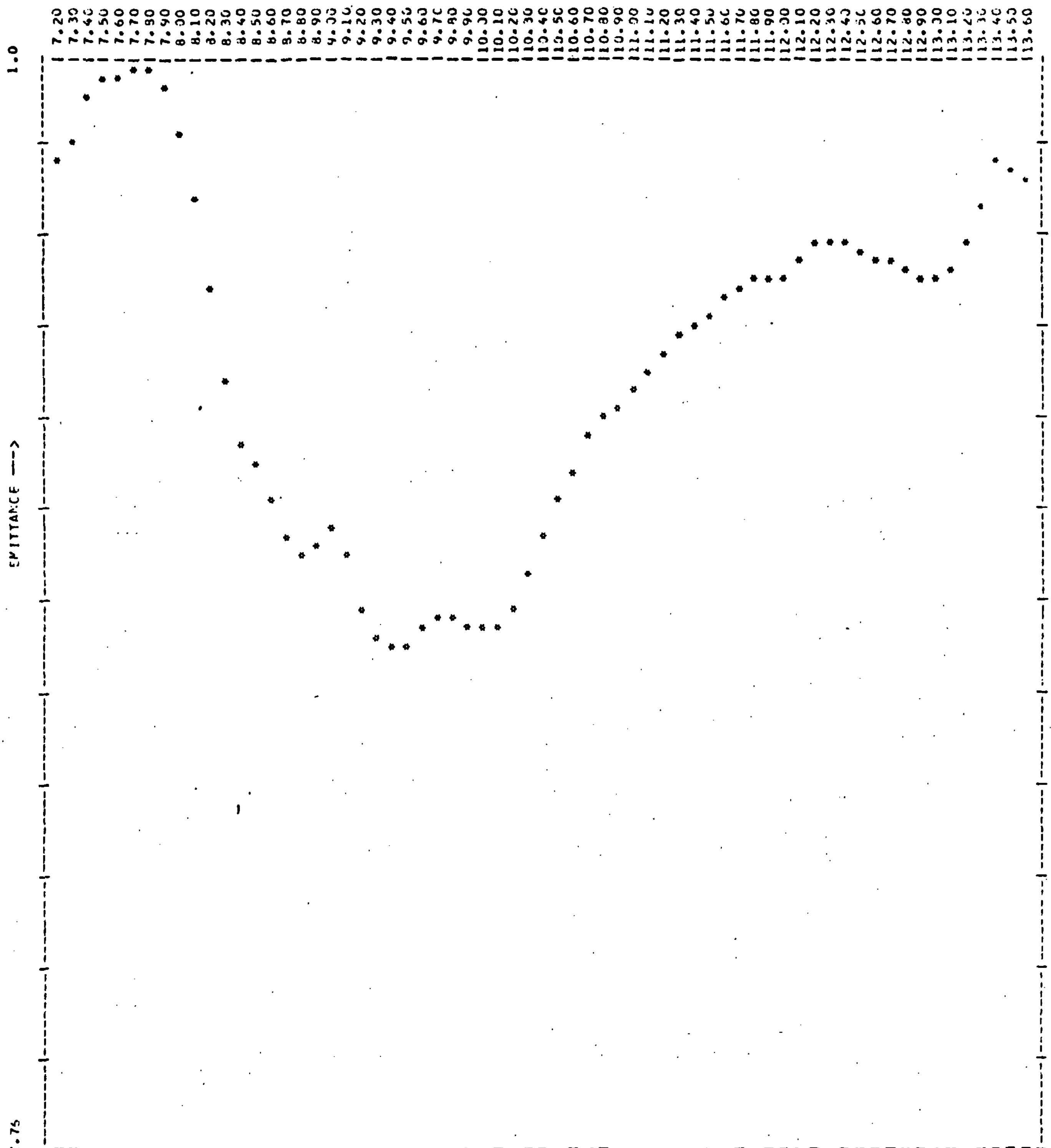
7.200	0.972	7.300	[illegible]	7.400	0.994	7.500	[illegible]	7.600	0.996	7.700	0.998	7.800	0.997	7.900	0.995
8.000	[illegible]	8.100	[illegible]	8.200	0.934	8.300	0.911	8.400	0.900	8.500	0.899	8.600	0.900	8.700	0.898
8.800	[illegible]	8.900	[illegible]	9.000	0.892	9.100	0.888	9.200	[illegible]	9.300	0.883	9.400	0.884	9.500	0.883
9.600	[illegible]	9.700	[illegible]	9.800	0.865	9.900	0.862	10.000	[illegible]	10.100	0.869	10.200	0.878	10.300	0.885
10.400	[illegible]	10.500	[illegible]	10.600	0.902	10.700	0.907	10.800	0.914	10.900	0.918	11.000	0.923	11.100	0.926
11.200	[illegible]	11.300	[illegible]	11.400	0.938	11.500	0.942	11.600	0.945	11.700	0.947	11.800	0.949	11.900	0.950
12.000	[illegible]	12.100	[illegible]	12.200	0.957	12.300	0.958	12.400	[illegible]	12.500	0.955	12.600	0.954	12.700	0.952
12.800	[illegible]	12.900	[illegible]	13.000	0.953	13.100	0.957	13.200	0.963	13.300	0.973	13.400	0.975	13.500	0.978
13.600	[illegible]														



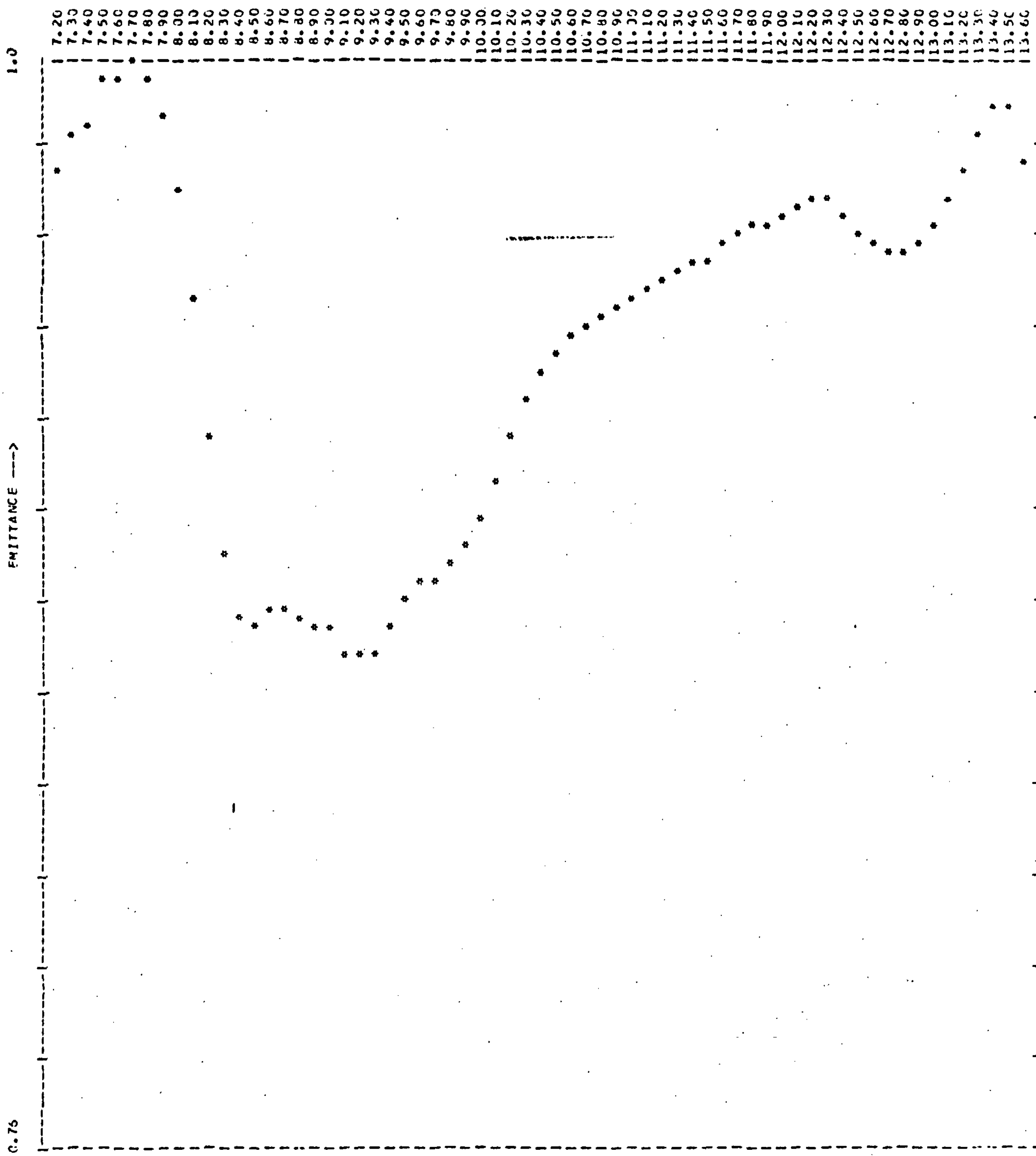
72 07 17 1100 CIRRO LAKE GRANODIORITE POLISHED
YC=-0.300 CALIB. DIST.=-4.17 VOLTS PER INCH= 0.0[illegible] OHMS= 448.50
INTERNAL REF. TEMPERATURE= 31.27 TARGET TEMPERATURE= 30.00
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECT [illegible]) = 27.[illegible]
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 [illegible]	7.300 [illegible]	7.400 [illegible]	7.500 0.993	7.600 [illegible]	7.700 0.999	7.800 0.997	7.900 0.993
8.000 [illegible]	8.100 [illegible]	8.200 [illegible]	8.300 0.918	8.400 0.904	8.500 [illegible]	8.600 0.903	8.700 [illegible]
8.800 [illegible]	8.900 [illegible]	9.000 [illegible]	9.100 [illegible]	9.200 [illegible]	9.300 0.880	9.400 0.881	9.500 [illegible]
9.600 [illegible]	9.700 [illegible]	9.800 [illegible]	9.900 [illegible]	10.000 [illegible]	10.100 0.877	10.200 0.883	10.300 [illegible]
10.400 [illegible]	10.500 [illegible]	10.600 [illegible]	10.700 0.911	10.800 [illegible]	10.900 0.920	11.000 0.925	11.100 0.931
11.200 [illegible]	11.300 [illegible]	11.400 [illegible]	11.500 0.943	11.600 0.948	11.700 0.951	11.800 0.951	11.900 0.951
12.000 [illegible]	12.100 [illegible]	12.200 [illegible]	12.300 [illegible]	12.400 [illegible]	12.500 [illegible]	12.600 0.955	12.700 [illegible]
12.800 [illegible]	12.900 [illegible]	13.000 [illegible]	13.100 [illegible]	13.200 [illegible]	13.300 0.966	13.400 0.975	13.500 0.985
13.600 [illegible]							



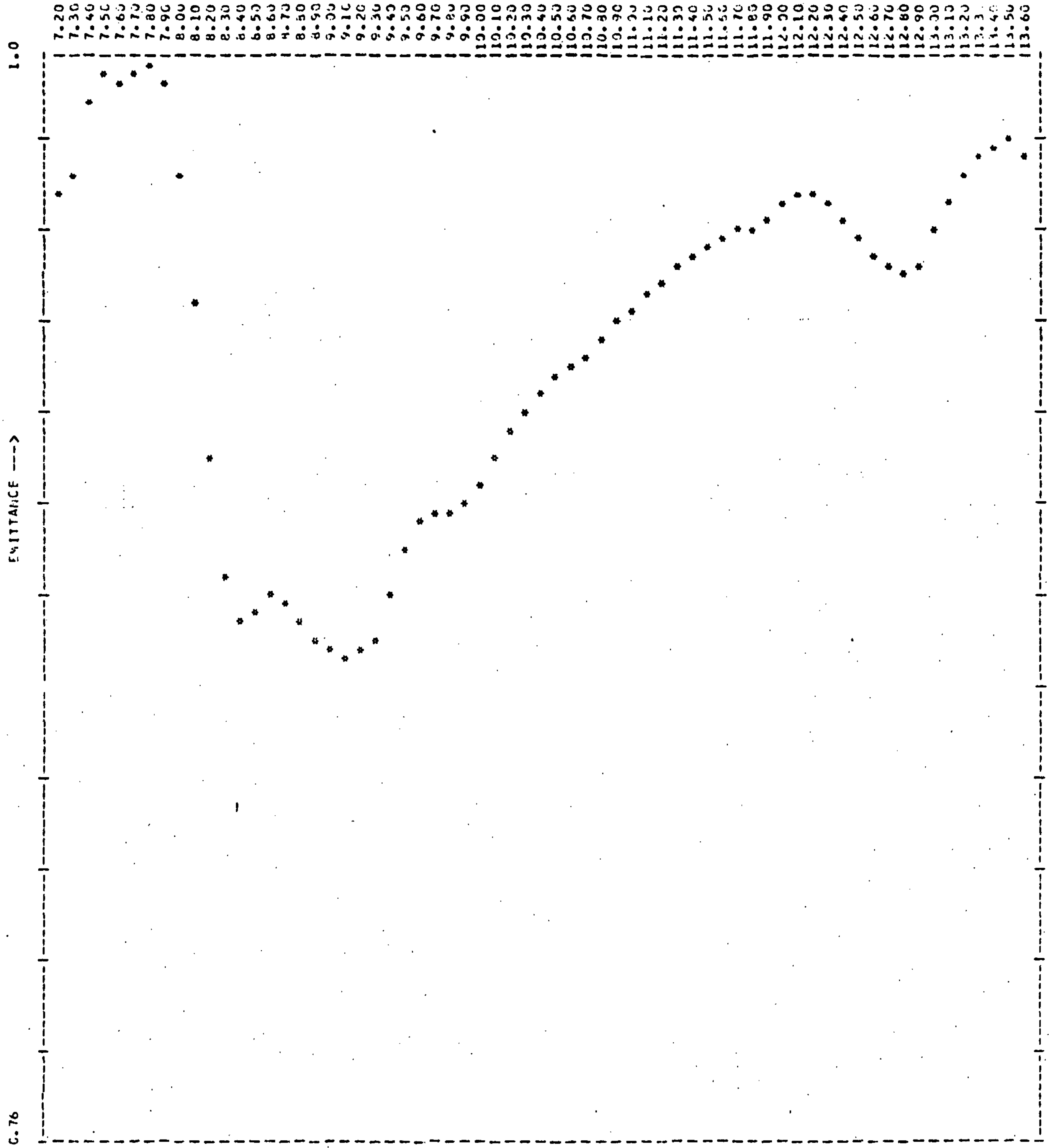
72 07 17   1105 .   [illegible] LAKE GRANODIORITE SHOWING TOURMALINE (50%) ROUGH
YC=-0.300   CALIB. DIST.=-3.00   VOLTS PER INCH= 0.0857   OHMS= 449.10
INTERNAL REF. TEMPERATURE= 31.[illegible]   TARGET TEMPERATURE= 29.00
WAVELENGTH OF EMIT. MAX.= 7.77
TARGET TEMPERATURE ([illegible]) = 27.10
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.978	7.300 0.983	7.400 0.994	7.500 0.997	7.600 0.998	7.700 0.999	7.800 0.999	7.900 0.995
8.000 0.985	8.100 0.970	8.200 0.951	8.300 0.931	8.400 0.916	8.500 0.912	8.600 0.906	8.700 0.896
8.800 0.894	8.900 0.896	9.000 0.898	9.100 0.894	9.200 0.881	9.300 0.874	9.400 0.873	9.500 0.874
9.600 0.877	9.700 0.879	9.800 0.879	9.900 0.876	10.000 0.877	10.100 0.876	10.200 0.882	10.300 0.893
10.400 0.901	10.500 0.915	10.600 0.912	10.700 0.918	10.800 0.923	10.900 0.926	11.000 0.928	11.100 0.933
11.200 0.937	11.300 0.941	11.400 0.943	11.500 0.945	11.600 0.948	11.700 0.951	11.800 0.953	11.900 0.952
12.000 0.953	12.100 0.956	12.200 0.961	12.300 0.961	12.400 0.961	12.500 0.959	12.600 0.957	12.700 0.956
12.800 0.954	12.900 0.953	13.000 0.953	13.100 0.954	13.200 0.961	13.300 0.970	13.400 0.978	13.500 0.977
13.600 0.975							



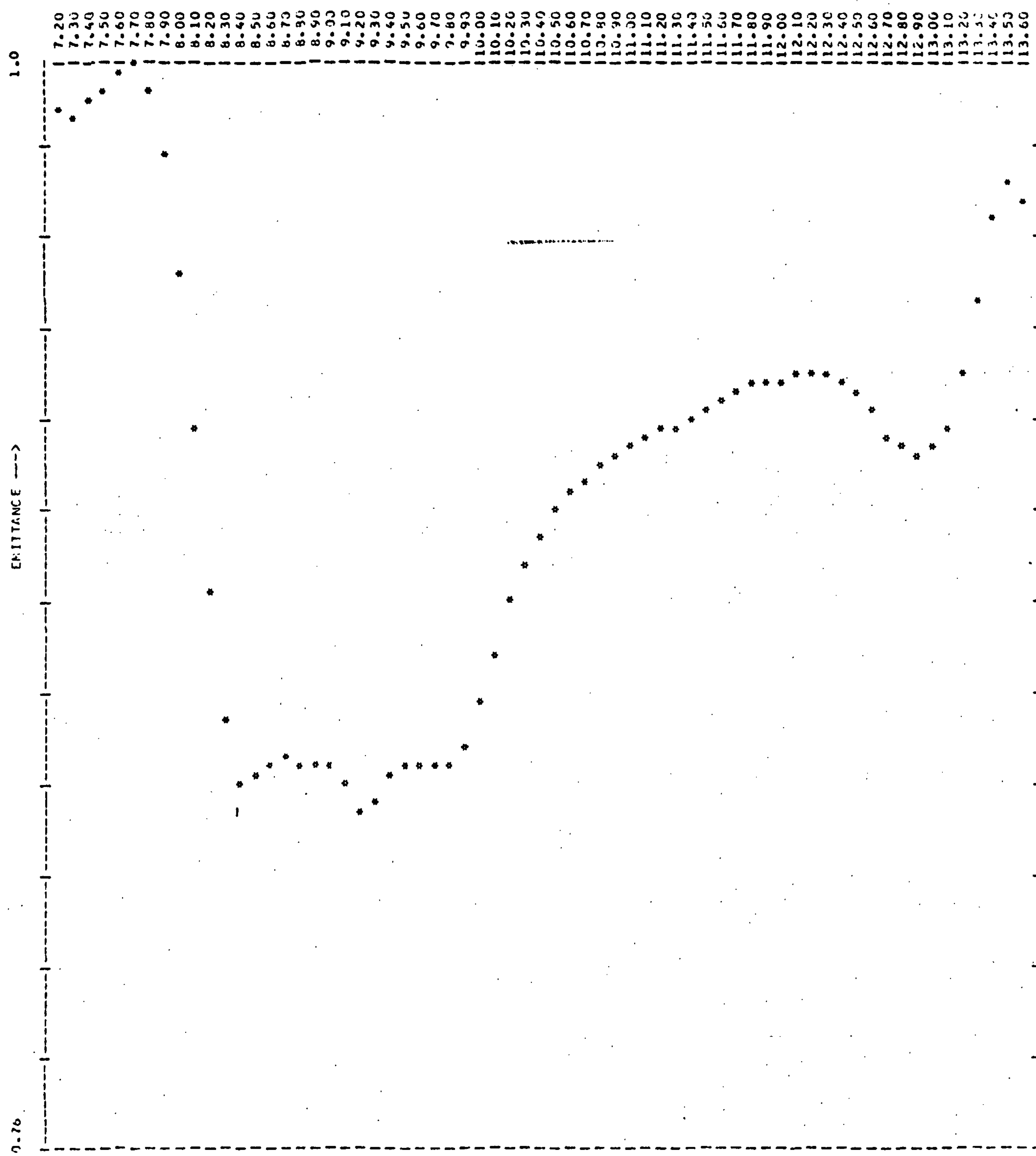
72 07 17   1110   FREMONT LAKE GRANODIORITE   ROUGH
YC=-0.300   CALIB. DIST.=-4.11   VOLTS PER INCH= 0.0730   OHMS= 449.50
INTERNAL REF. TEMPERATURE= 31.71   TARGET TEMPERATURE= 29.50
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECIMEN METER) = 26.74
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.977	7.300 [illegible]	7.400 0.987	7.500 0.996	7.600 0.997	7.700 1.001	7.800 0.997	7.900 0.993
8.000 0.974	8.100 [illegible]	8.200 0.919	8.300 0.893	8.400 0.878	8.500 0.877	8.600 0.882	8.700 0.881
8.800 0.879	8.900 0.877	9.000 0.876	9.100 0.871	9.200 0.870	9.300 0.870	9.400 0.877	9.500 0.883
9.600 0.886	9.700 0.888	9.800 0.891	9.900 0.895	10.000 0.902	10.100 0.910	10.200 0.919	10.300 0.927
10.400 0.933	10.500 0.937	10.600 0.940	10.700 0.943	10.800 0.946	10.900 0.948	11.000 0.950	11.100 0.951
11.200 0.953	11.300 0.955	11.400 0.957	11.500 0.958	11.600 0.960	11.700 0.963	11.800 0.965	11.900 0.966
12.000 0.967	12.100 [illegible]	12.200 0.971	12.300 0.970	12.400 0.968	12.500 0.964	12.600 0.961	12.700 0.959
12.800 0.959	12.900 0.961	13.000 0.966	13.100 0.971	13.200 0.977	13.300 0.985	13.400 0.991	13.500 0.992
13.600 [illegible]							



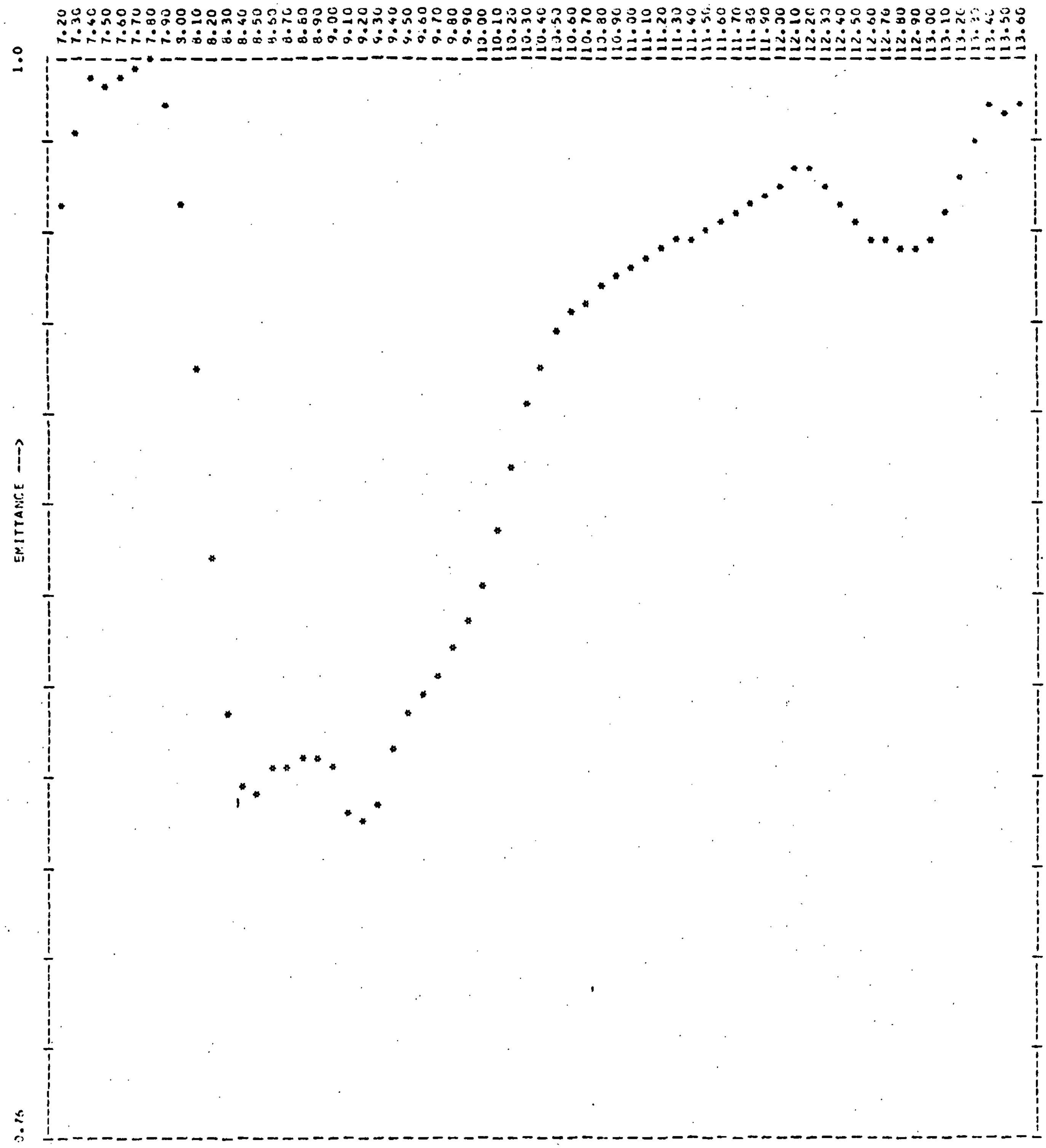
72 07 17 1115 CASCADE CREEK GRANITE NASA #302 ROUGH
YC=-0.300 CALIB. DIST.=-5.95 VOLTS PER INCH= 0.0759 OHMS= 450.00
INTERNAL REF. TEMPERATURE= 32.23 TARGET TEMPERATURE= 30.50
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 27.05
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.973	7.300 0.975	7.400 0.991	7.500 0.996	7.600 0.995	7.700 0.996	7.800 0.999	7.900 0.994
8.000 0.975	8.100 0.966	8.200 0.914	8.300 0.888	8.400 0.877	8.500 0.878	8.600 0.883	8.700 0.881
8.800 0.877	8.900 0.872	9.000 0.871	9.100 0.869	9.200 0.871	9.300 0.873	9.400 0.883	9.500 0.893
9.600 0.899	9.700 0.900	9.800 0.903	9.900 0.902	10.000 0.907	10.100 0.912	10.200 0.918	10.300 0.923
10.400 0.927	10.500 0.930	10.600 0.932	10.700 0.935	10.800 0.939	10.900 0.942	11.000 0.945	11.100 0.948
11.200 0.951	11.300 0.955	11.400 0.957	11.500 0.959	11.600 0.960	11.700 0.962	11.800 0.964	11.900 0.965
12.000 0.966	12.100 0.971	12.200 0.972	12.300 0.969	12.400 0.965	12.500 0.960	12.600 0.957	12.700 0.954
12.800 0.956	12.900 0.956	13.000 0.962	13.100 0.969	13.200 0.975	13.300 0.979	13.400 0.981	13.500 0.983
13.600 0.979							



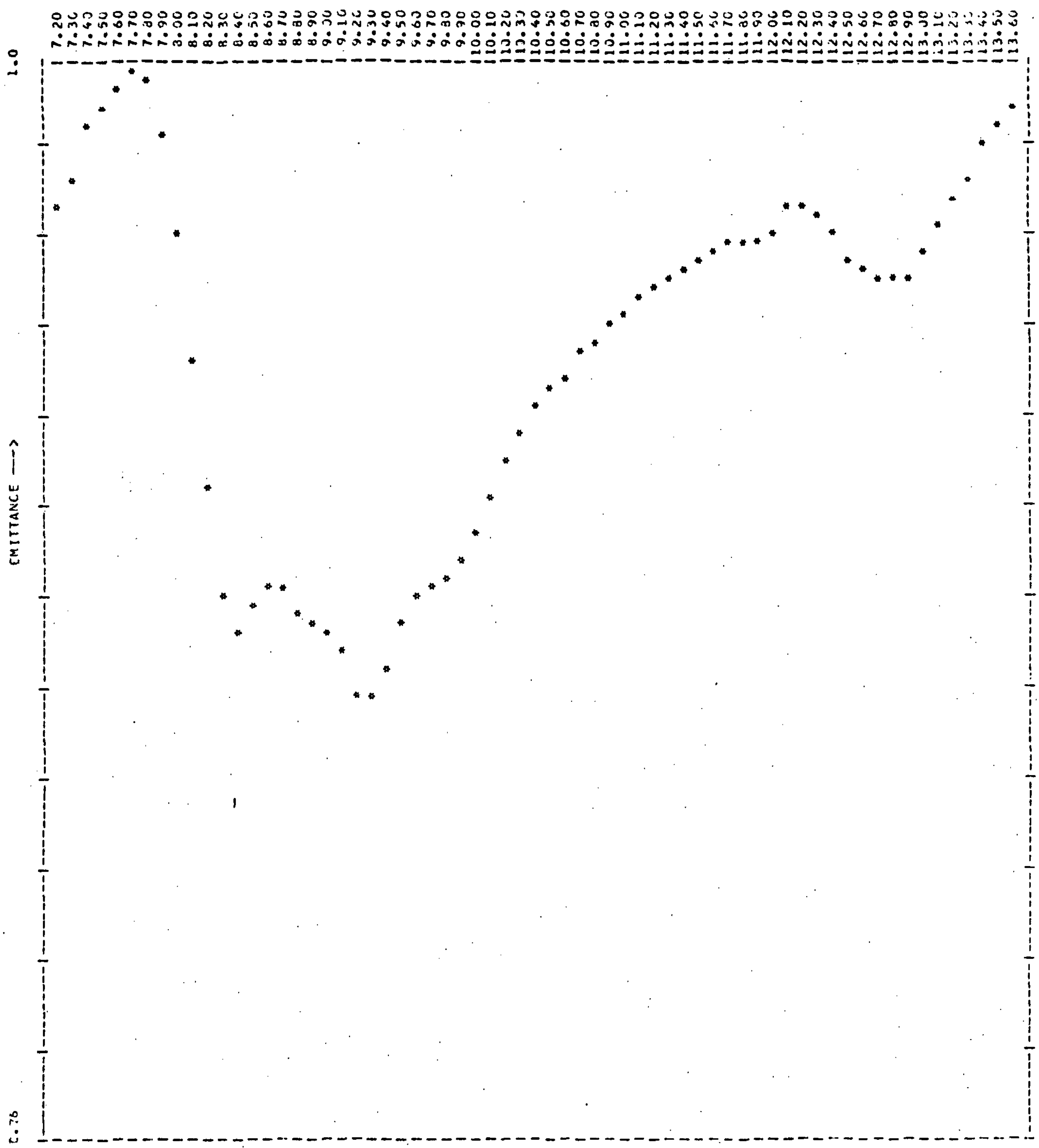
72 07 17   1125   DOROTHY LAKE ALASKITE-GRANITE   (60% FELDSPAR)   SAWED
YC=-0.300   CALIB. DIST.=-3.37   VOLTS PER INCH= 0.0775   OHMS= 452.20
INTERNAL REF. TEMPERATURE= 33.65   TARGET TEMPERATURE= 34.06
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROSCOPIC) = 33.91
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.990	7.300 0.983	7.400 0.993	7.500 0.994	7.600 0.998	7.700 1.001	7.800 0.996	7.900 0.982
8.000 0.955	8.100 0.921	8.200 0.884	8.300 0.856	8.400 0.843	8.500 0.845	8.600 0.847	8.700 0.848
8.800 0.848	8.900 0.848	9.000 0.847	9.100 0.842	9.200 0.838	9.300 0.839	9.400 0.845	9.500 0.848
9.600 0.848	9.700 0.847	9.800 0.847	9.900 0.852	10.000 0.861	10.100 0.871	10.200 0.882	10.300 0.891
10.400 0.898	10.500 0.903	10.600 0.907	10.700 0.910	10.800 0.913	10.900 0.915	11.000 0.916	11.100 0.918
11.200 0.920	11.300 0.921	11.400 0.923	11.500 0.925	11.600 0.927	11.700 0.929	11.800 0.930	11.900 0.930
12.000 0.932	12.100 0.933	12.200 0.934	12.300 0.933	12.400 0.932	12.500 0.929	12.600 0.924	12.700 0.920
12.800 0.916	12.900 0.915	13.000 0.916	13.100 0.922	13.200 0.934	13.300 0.949	13.400 0.966	13.500 0.974
13.600 0.971							



72 07 17 1130 DOROTHY LAKE ALASKITE-GRANITE NASA #162 ROUGH
YC=-3.333 CALIB. DIST.=-3.32 VOLTS PER INCH= 0.0904 GAIN= 450.00
INTERNAL REF. TEMPERATURE= 32.23 TARGET TEMPERATURE= 30.00
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 27.92
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.969	7.300 [illegible]	7.400 0.997	7.500 0.994	7.600 0.997	7.700 0.999	7.800 1.000	7.900 0.991
8.000 0.969	8.100 0.933	8.200 0.891	8.300 0.857	8.400 0.841	8.500 0.839	8.600 0.845	8.700 0.845
8.800 0.847	8.900 0.844	9.000 0.845	9.100 0.835	9.200 0.832	9.300 0.836	9.400 0.850	9.500 0.857
9.600 0.862	9.700 [illegible]	9.800 0.870	9.900 0.877	10.000 0.885	10.100 0.897	10.200 0.911	10.300 0.924
10.400 0.944	10.500 [illegible]	10.600 0.94[illegible]	10.700 0.948	10.800 0.950	10.900 0.953	11.000 0.955	11.100 0.957
11.200 0.95[illegible]	11.300 0.96[illegible]	11.400 0.962	11.500 0.964	11.600 0.966	11.700 0.968	11.800 0.970	11.900 0.970
12.000 0.972	12.100 0.976	12.200 0.977	12.300 0.973	12.400 0.969	12.500 0.965	12.600 0.962	12.700 0.960
12.800 0.95[illegible]	12.900 0.961	13.000 0.961	13.100 0.966	13.200 0.975	13.300 0.984	13.400 0.990	13.500 0.988
13.600 0.991							

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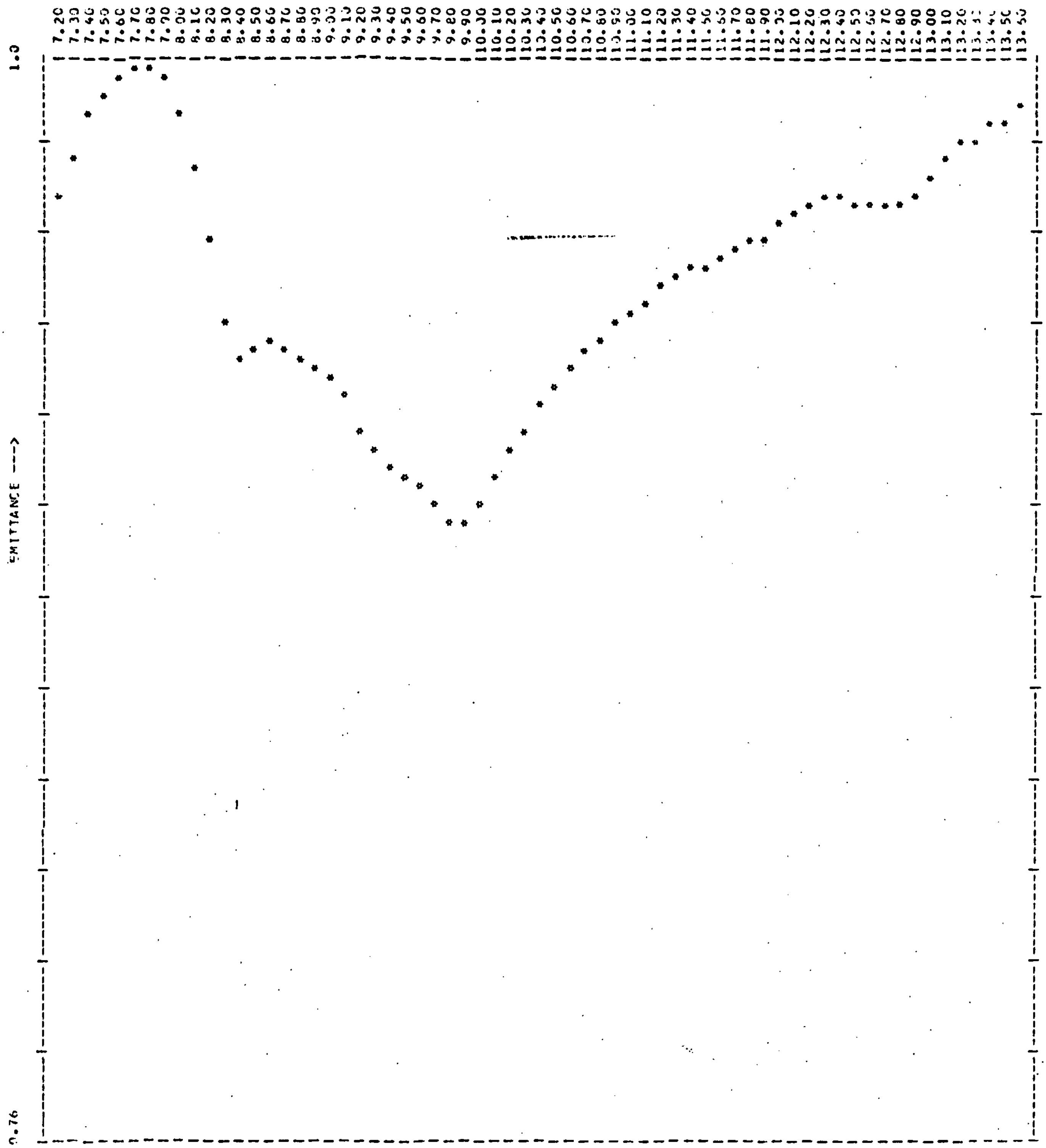
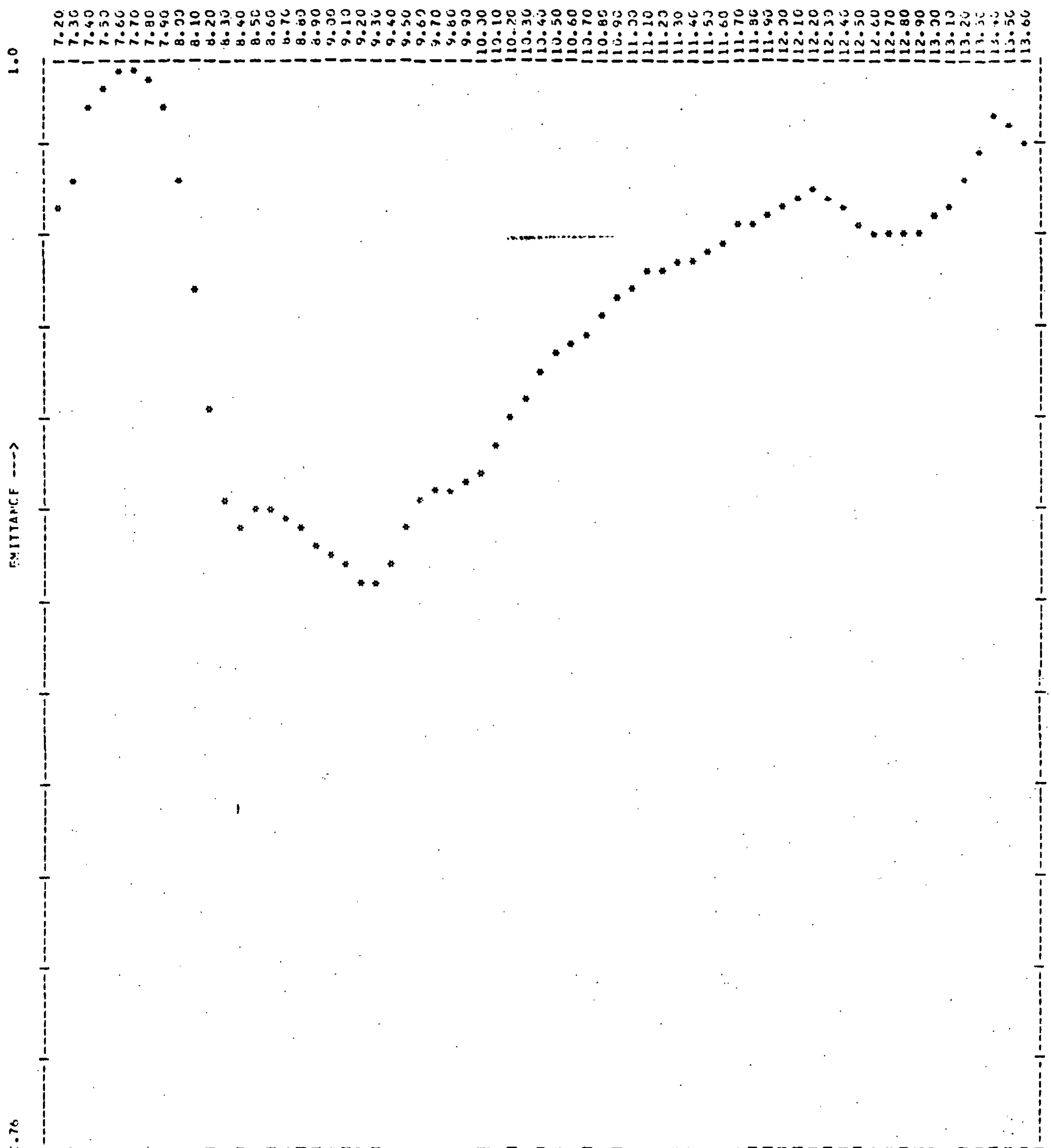
72 07 17   1135        MILLCREEK PORPHYRITIC QUARTZ MONZONITE NASA #208    ROUGH
YC=-0.300   CALIB. DIST.=-4.33   VOLTS PER INCH= 0.0621   OHMS= 450.50
INTERNAL REF. TEMPERATURE= 32.56   TARGET TEMPERATURE= 33.00
WAVELENGTH OF EMIT. MAX.=  7.75
TARGET TEMPERATURE (SPECTROMETER) =  31.93
EMITTANCES AT SPECIFIC WAVELENGTHS
```

7.200 0.970	7.300 0.976	7.400 0.986	7.500 0.990	7.600 0.996	7.700 0.999	7.800 0.997	7.900 0.986
8.000 0.974	8.100 0.935	8.200 0.906	8.300 0.883	8.400 0.875	8.500 0.881	8.600 0.886	8.700 0.884
8.800 0.880	8.900 0.876	9.000 0.875	9.100 0.870	9.200 0.862	9.300 0.860	9.400 0.867	9.500 0.877
9.600 0.884	9.700 0.885	9.800 0.887	9.900 0.890	10.000 0.897	10.100 0.905	10.200 0.913	10.300 0.919
10.400 0.924	10.500 0.929	10.600 0.932	10.700 0.936	10.800 0.940	10.900 0.943	11.000 0.946	11.100 0.949
11.200 0.952	11.300 0.954	11.400 0.954	11.500 0.956	11.600 0.959	11.700 0.961	11.800 0.962	11.900 0.962
12.000 0.964	12.100 0.964	12.200 0.970	12.300 0.967	12.400 0.962	12.500 0.958	12.600 0.955	12.700 0.953
12.800 0.952	12.900 0.955	13.000 0.959	13.100 0.965	13.200 0.970	13.300 0.974	13.400 0.984	13.500 0.988
13.600 0.991							



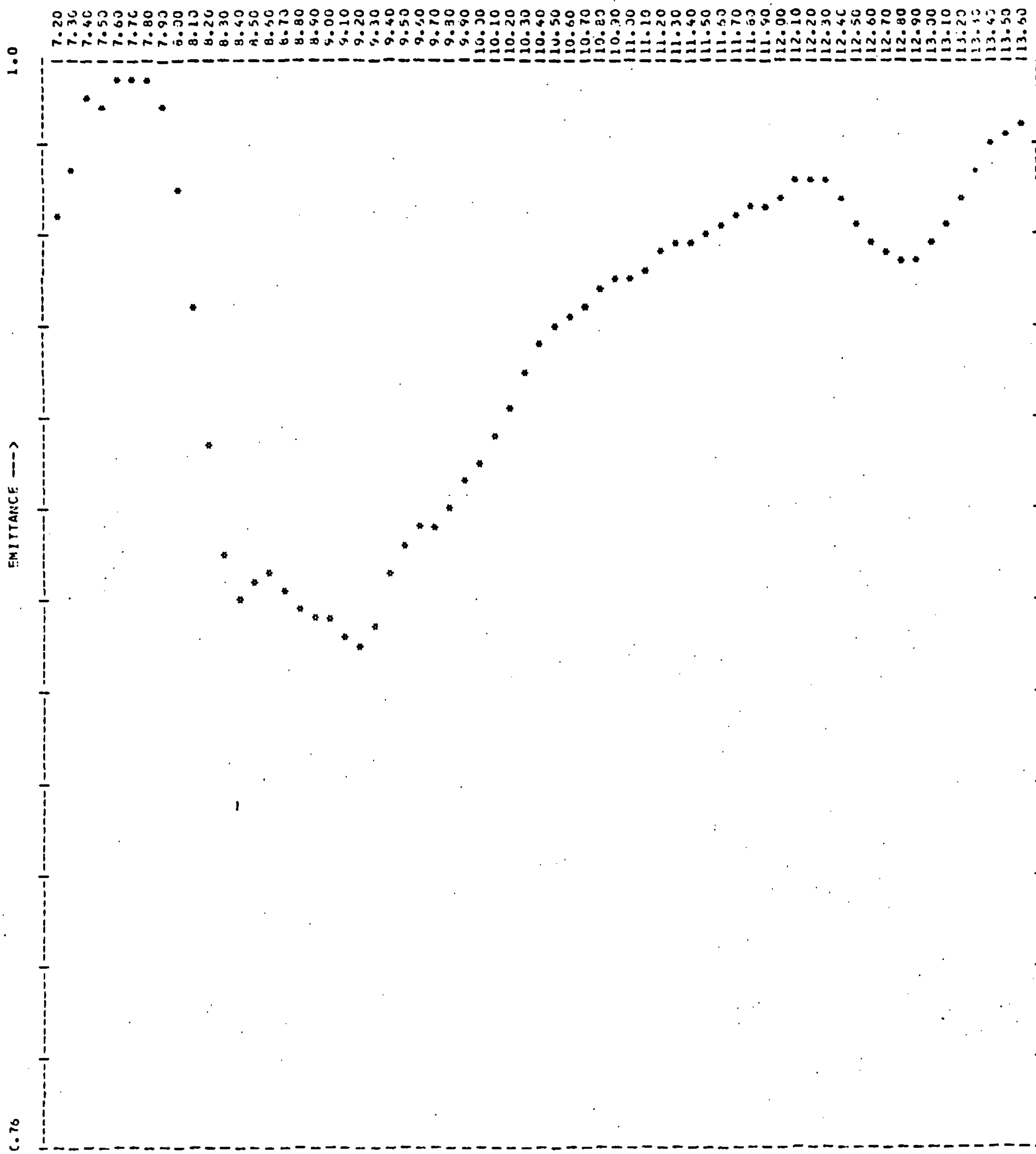
72 07 17 1140 MILLCREEK PORPHYRITIC QUARTZ MONZONITE [illegible]LITH (QUARTZ/BIOTITE
YC=40.300 CALIB. DIST.=-5.93 VOLTS PER INCH= 0.0500 OHMS= 459.50
INTERNAL REF. TEMPERATURE= 32.56 TARGET TEMPERATURE= 33.00
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTRUM FIT-2) = 31.21
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.972	7.300 0.977	7.400 0.989	7.500 0.994	7.600 0.997	7.700 0.998	7.800 0.999	7.900 0.996
8.000 0.991	8.100 0.977	8.200 0.960	8.300 0.944	8.400 0.936	8.500 0.937	8.600 0.939	8.700 0.938
8.800 0.935	8.900 0.933	9.000 0.932	9.100 0.927	9.200 0.920	9.300 0.914	9.400 0.911	9.500 0.909
9.600 0.906	9.700 0.902	9.800 0.899	9.900 0.899	10.000 0.902	10.100 0.908	10.200 0.915	10.300 0.920
10.400 0.924	10.500 0.929	10.600 0.933	10.700 0.937	10.800 0.940	10.900 0.942	11.000 0.945	11.100 0.946
11.200 0.951	11.300 0.953	11.400 0.955	11.500 0.956	11.600 0.957	11.700 0.958	11.800 0.960	11.900 0.962
12.000 0.966	12.100 0.967	12.200 0.970	12.300 0.971	12.400 0.971	12.500 0.970	12.600 0.969	12.700 0.970
12.800 0.969	12.900 0.971	13.000 0.975	13.100 0.979	13.200 0.983	13.300 0.984	13.400 0.987	13.500 0.988
13.600 0.991							



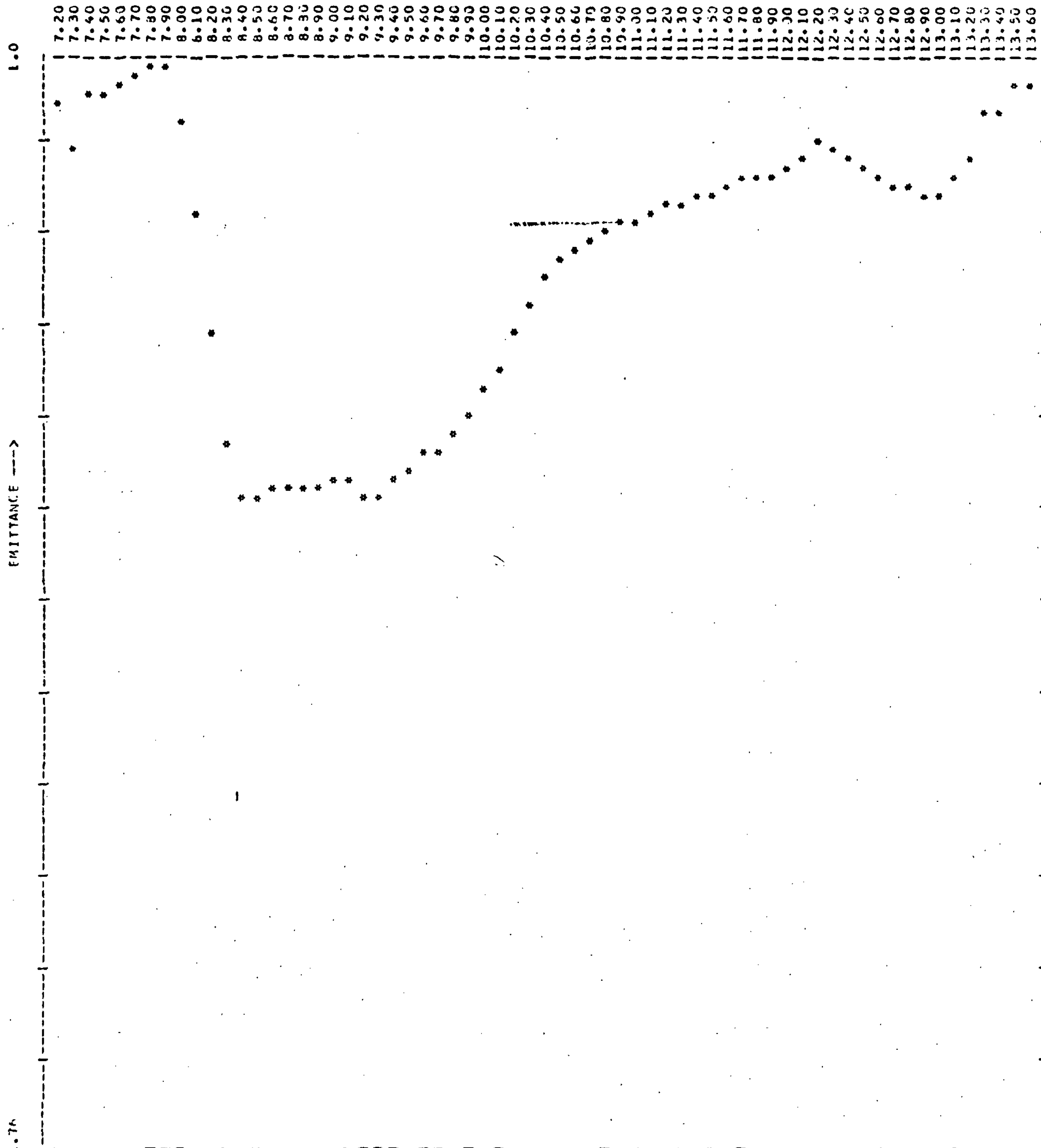
72 07 17 1145 PATTERSON GRADE GRAPHITE NASA #316 (ROUGH SURFACE)
YC=-0.300 CALIB. DIST.=-4.30 VOLTS PER INCH= 0.0625 OHMS= 450.50
INTERNAL REF. TEMPERATURE= 32.55 TARGET TEMPERATURE= 32.00
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 41.15
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.970	7.300 0.975	7.400 0.990	7.500 0.995	7.600 0.998	7.700 0.998	7.800 0.997	7.900 0.991
8.000 0.975	8.100 0.951	8.200 0.925	8.300 0.906	8.400 0.930	8.500 0.903	8.600 0.904	8.700 0.907
8.800 0.898	8.900 0.895	9.000 0.893	9.100 0.891	9.200 0.887	9.300 0.886	9.400 0.892	9.500 0.899
9.600 0.905	9.700 0.907	9.800 0.907	9.900 0.908	10.000 0.912	10.100 0.916	10.200 0.922	10.300 0.928
10.400 0.933	10.500 0.937	10.600 0.940	10.700 0.942	10.800 0.945	10.900 0.948	11.000 0.952	11.100 0.954
11.200 0.955	11.300 0.957	11.400 0.958	11.500 0.960	11.600 0.962	11.700 0.964	11.800 0.965	11.900 0.966
12.000 0.969	12.100 0.971	12.200 0.972	12.300 0.971	12.400 0.968	12.500 0.966	12.600 0.964	12.700 0.963
12.800 0.962	12.900 0.963	13.000 0.966	13.100 0.970	13.200 0.976	13.300 0.980	13.400 0.989	13.500 0.987
13.600 0.984							



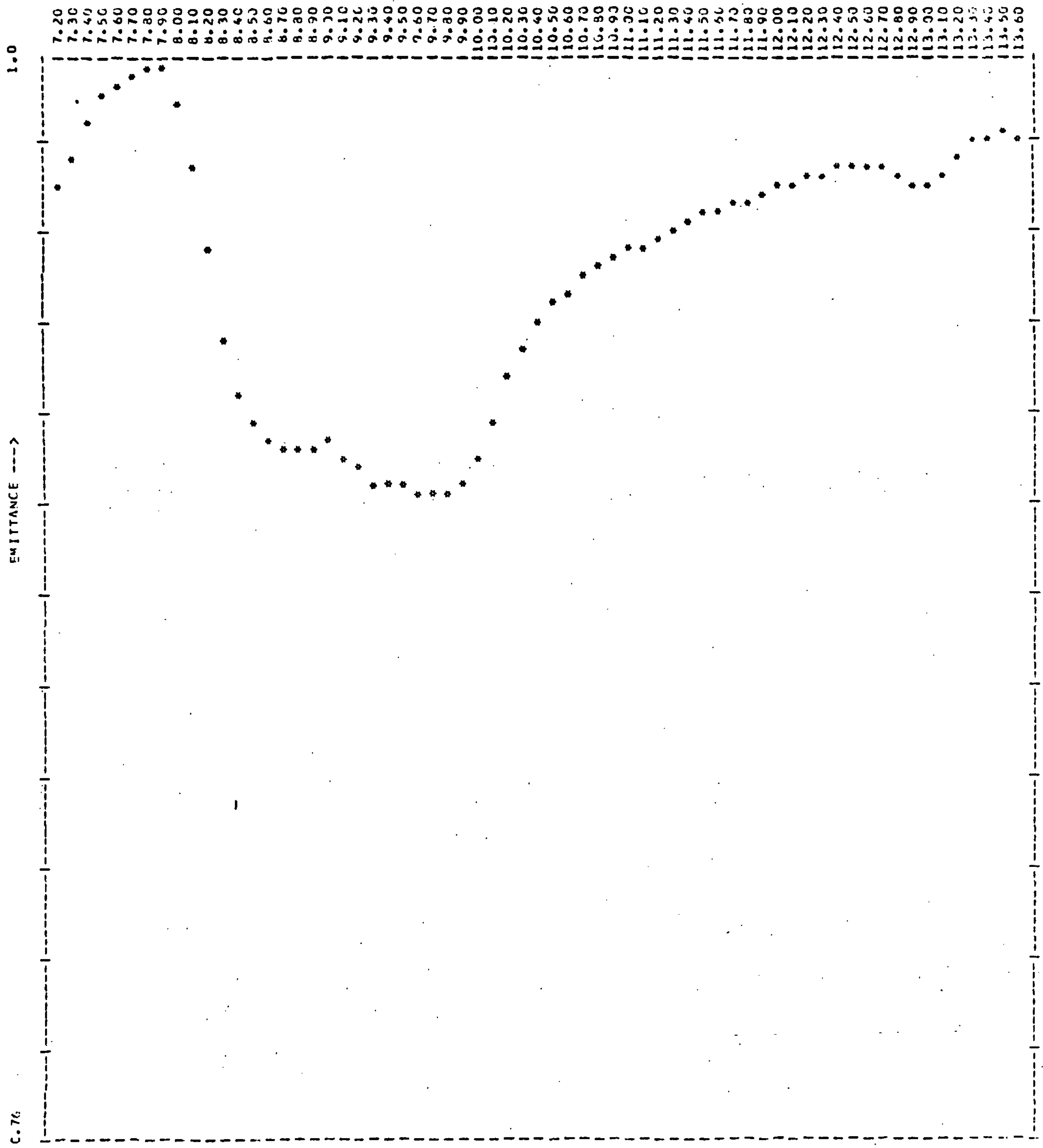
72 07 17 1150 CATHEDRAL PEAK PORPHYRITIC QUARTZ MONZONITE MODERATELY WEATHERED
YC=-0.300 CALIB. DIST.=-3.74 VOLTS PER INCH= 0.0781 OHMS= 450.50
INTERNAL REF. TEMPERATURE= 12.56 TARGET TEMPERATURE= 29.00
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE ([illegible]) = 29.17
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.966	7.300 0.97[illegible]	7.400 0.993	7.500 0.991	7.600 0.996	7.700 0.997	7.800 0.998	7.900 0.991
8.000 0.974	8.100 0.947	8.200 0.917	8.300 0.893	8.400 0.884	8.500 0.886	8.600 0.889	8.700 0.885
8.800 0.881	8.900 0.879	9.000 0.878	9.100 0.876	9.200 0.874	9.300 0.878	9.400 0.888	9.500 0.895
9.600 0.899	9.700 0.899	9.800 0.903	9.900 0.908	10.000 0.913	10.100 0.918	10.200 0.925	10.300 0.932
10.400 0.939	10.500 0.944	10.600 0.946	10.700 0.948	10.800 0.950	10.900 0.952	11.000 0.954	11.100 0.955
11.200 0.958	11.300 0.960	11.400 0.962	11.500 0.963	11.600 0.965	11.700 0.967	11.800 0.968	11.900 0.969
12.000 0.971	12.100 0.974	12.200 0.976	12.300 0.974	12.400 0.970	12.500 0.965	12.600 0.961	12.700 0.958
12.800 0.957	12.900 0.955	13.000 0.961	13.100 0.965	13.200 0.971	13.300 0.978	13.400 0.982	13.500 0.984
13.600 0.986							



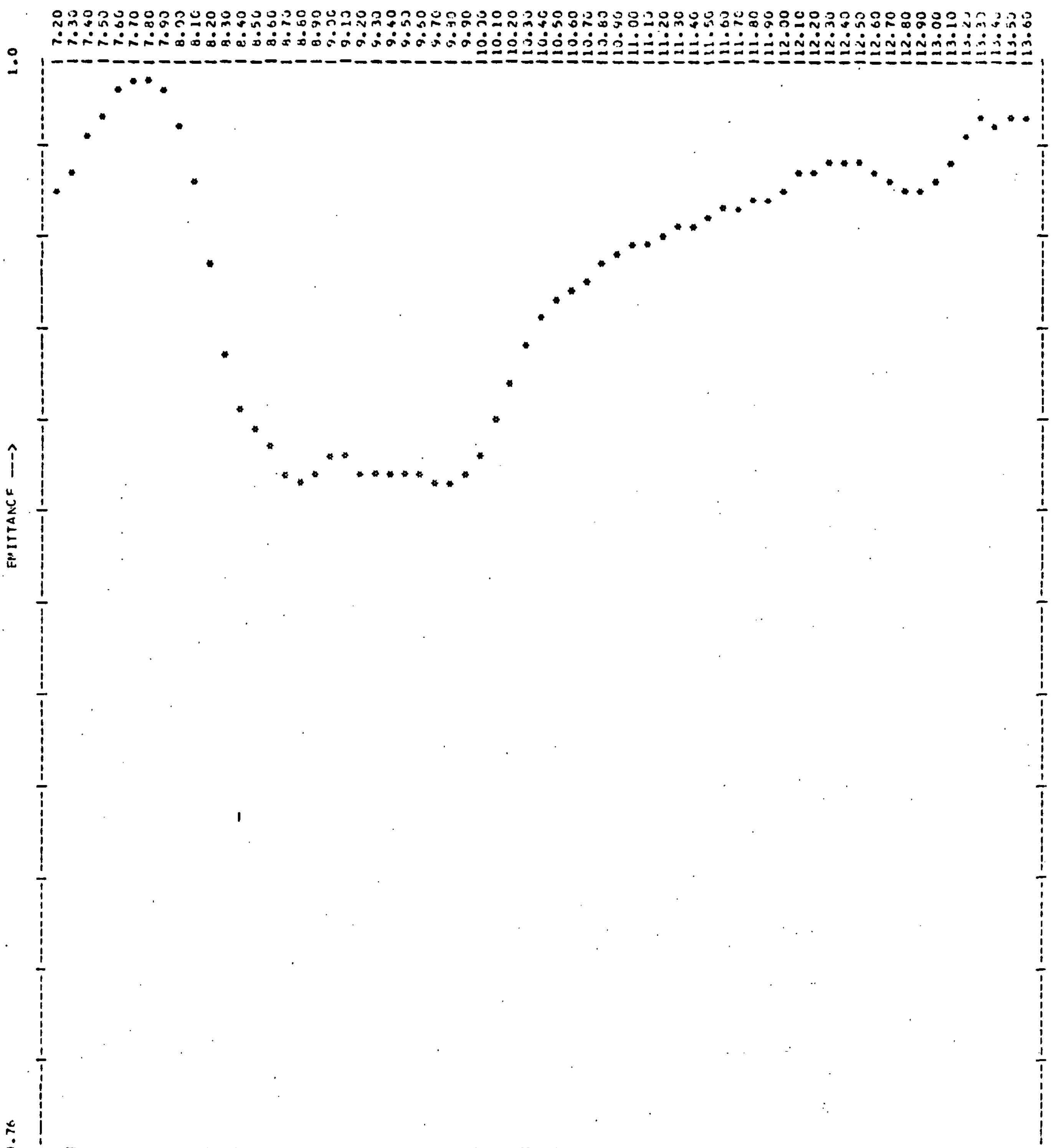
72 07 17   1155   CATHEDRAL PEAK PORPHYRITIC QUARTZ MONZONITE FRESH SURFACE
YC=-0.300   CALIB. DIST.=-3.79   VOLTS PER INCH= 0.0792   CEMS= 439.59
INTERNAL REF. TEMPERATURE= 32.56   TARGET TEMPERATURE= 30.06
WAVELENGTH OF EMIT. MAX.= 7.80
TARGET TEMPERATURE (SPECTROMETER) = 27.32
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.991	7.300 0.982	7.400 0.992	7.500 0.994	7.600 0.995	7.700 0.996	7.800 1.000	7.900 0.998
8.000 0.983	8.100 0.967	8.200 0.940	8.300 0.917	8.400 0.905	8.500 0.905	8.600 0.907	8.700 0.907
8.800 0.908	8.900 0.908	9.000 0.910	9.100 0.910	9.200 0.906	9.300 0.906	9.400 0.910	9.500 0.912
9.600 0.914	9.700 0.916	9.800 0.919	9.900 0.923	10.000 0.928	10.100 0.933	10.200 0.940	10.300 0.947
10.400 0.953	10.500 0.957	10.600 0.959	10.700 0.961	10.800 0.963	10.900 0.964	11.000 0.965	11.100 0.966
11.200 0.968	11.300 0.971	11.400 0.971	11.500 0.972	11.600 0.973	11.700 0.975	11.800 0.976	11.900 0.976
12.000 0.977	12.100 0.979	12.200 0.982	12.300 0.981	12.400 0.979	12.500 0.977	12.600 0.975	12.700 0.973
12.800 0.973	12.900 0.971	13.000 0.971	13.100 0.974	13.200 0.980	13.300 0.990	13.400 0.989	13.500 0.994
13.600 0.994							



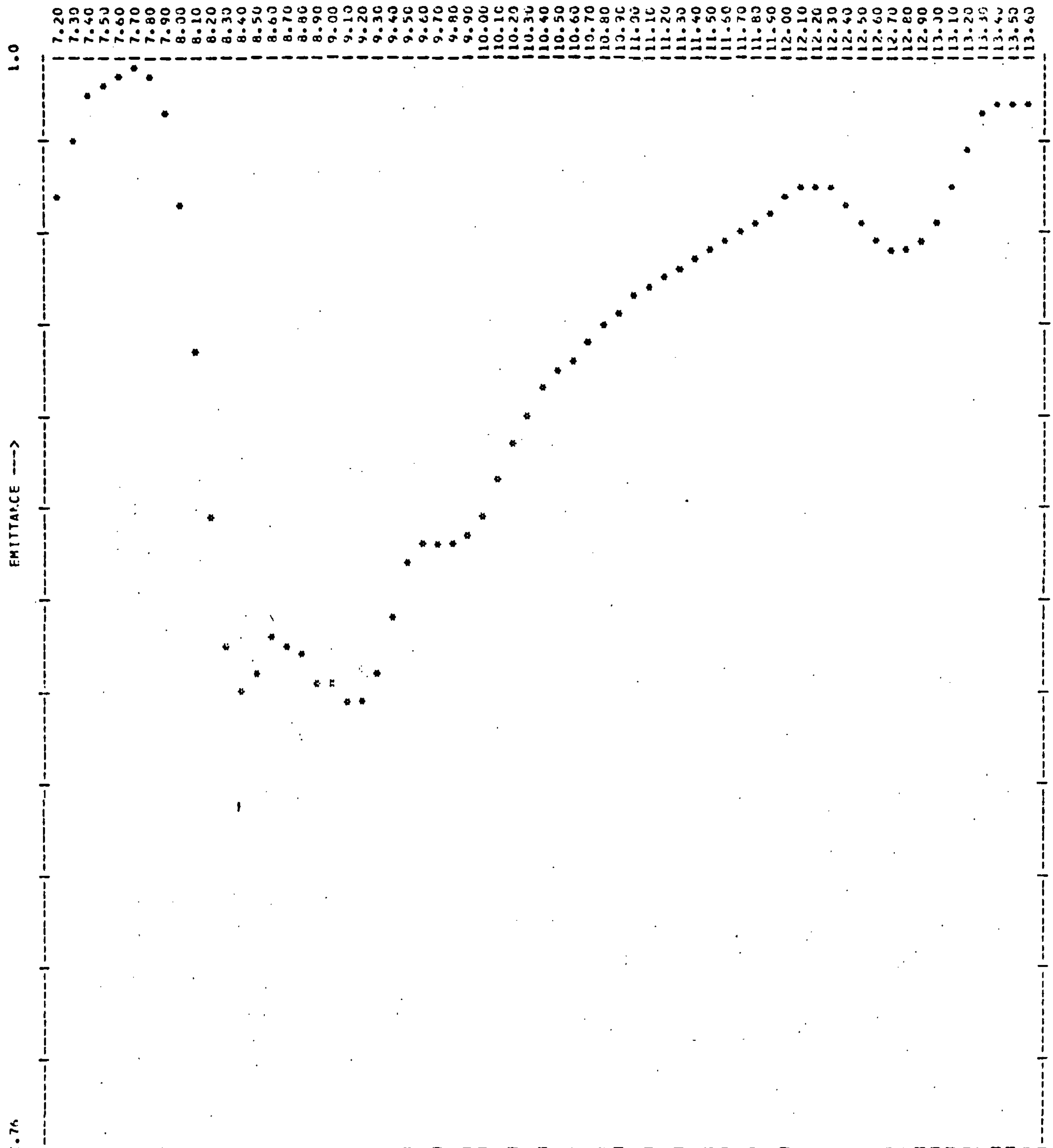
72 07 17 1235 CASE A231 TOPAZ LAKE -MICROCLINE PHENOCRYST ROUGH SURFACE
YC=-0.300 CALIB. DIST.=-5.?4 VOLTS PER INCH= 0.0505 OHMS= 450.50
INTERNAL REF. TEMPERATURE= 32.[illegible] TARGET TEMPERATURE= 0.00
WAVELENGTH OF EMIT. MAX.= 7.77
TARGET TEMPERATURE (SPECIFIED) = 32.00
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.973	7.300	0.98[illegible]	7.400	0.989	7.500	0.992	7.600	0.995	7.700	0.998	7.800	1.000	7.900	0.999
8.000	0.992	8.100	0.977	8.200	0.958	8.300	0.94[illegible]	8.400	0.927	8.500	0.920	8.600	0.918	8.700	0.919
8.800	0.91[illegible]	8.900	[illegible]	9.000	0.917	9.100	0.913	9.200	0.911	9.300	0.907	9.400	0.907	9.500	0.906
9.600	0.905	9.700	[illegible]	9.800	0.906	9.900	0.906	10.000	0.914	10.100	0.921	10.200	0.930	10.300	0.937
10.400	0.94[illegible]	10.500	[illegible]	10.600	0.950	10.700	0.953	10.800	0.955	10.900	0.957	11.000	0.959	11.100	0.960
11.200	0.961	11.300	0.962	11.400	0.964	11.500	0.966	11.600	0.968	11.700	0.969	11.800	0.970	11.900	0.971
12.000	0.972	12.100	0.973	12.200	0.975	12.300	0.976	12.400	0.977	12.500	0.977	12.600	0.977	12.700	0.977
12.800	0.976	12.900	0.973	13.000	0.972	13.100	0.975	13.200	0.978	13.300	0.983	13.400	0.983	13.500	0.984
13.600	0.984														



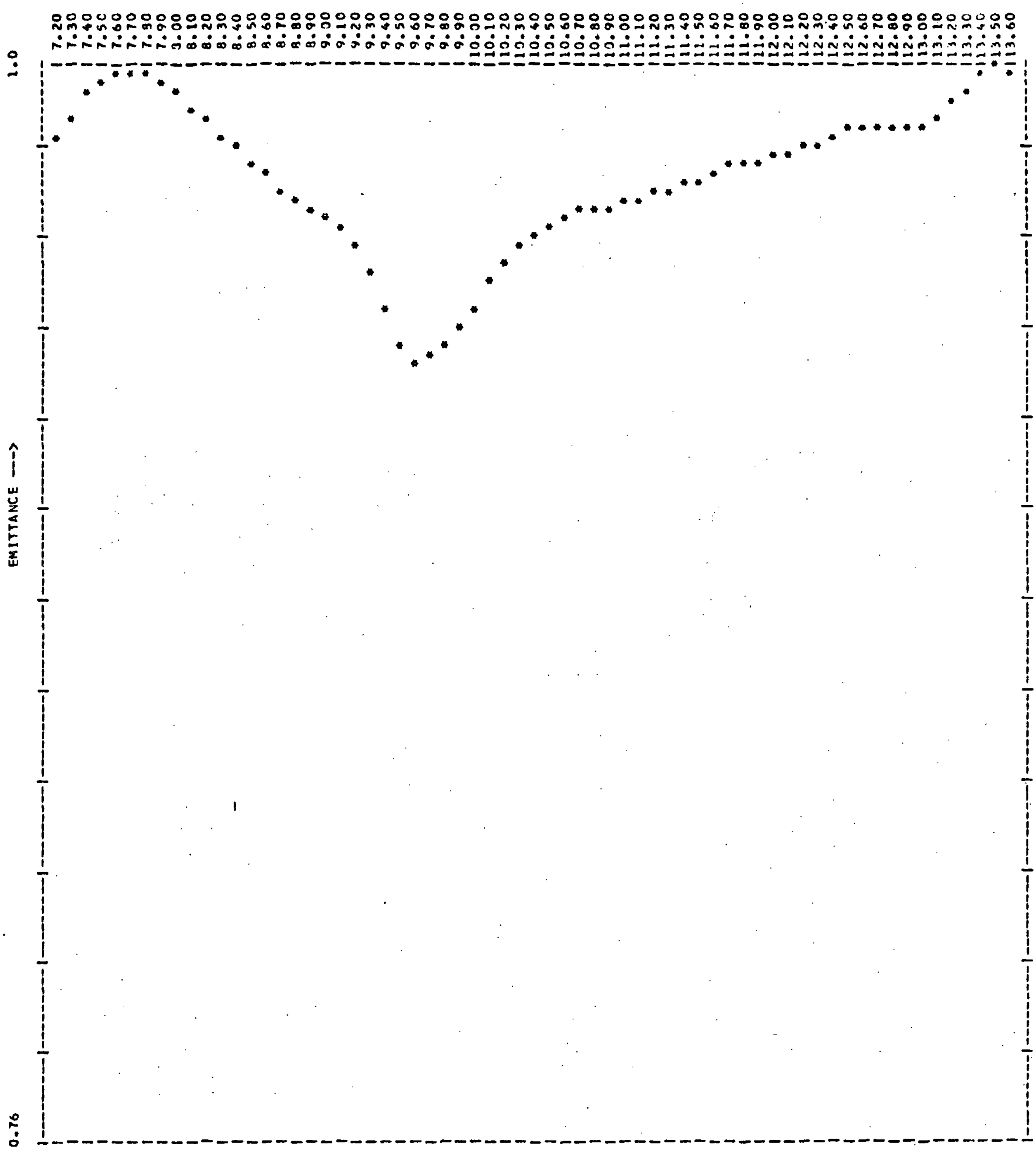
72 07 17 1215 NASA #231 TOPAZ LAKE- MICROCLINE PHENOCRYST ROUGH SURFACE
YC=-[illegible] CALIB. DIST.=-[illegible] VOLTS PER INCH= 0.0507 CHYS= 451.50
INTERNAL REF. TEMPERATURE= 33.2[illegible] TARGET TEMPERATURE= 32.00
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECIFIED) = 31.79
EMITTANCES AT SPECIFIC WAVELENGTH

7.200 0.973	7.300 0.977	7.400 0.986	7.500 0.990	7.600 0.995	7.700 0.997	7.400 0.997	7.900 0.995
8.000 0.987	8.100 0.975	8.200 0.957	8.300 [illegible]	8.400 0.925	8.500 0.920	8.600 0.916	8.700 0.911
8.800 0.908	8.900 0.911	[illegible] 0.915	9.100 0.915	9.200 0.912	9.300 0.913	9.400 0.911	9.500 0.911
9.600 0.910	9.700 [illegible]	[illegible] 0.909	9.900 0.919	10.000 0.915	10.100 0.922	10.200 0.932	10.300 0.940
10.400 0.945	10.500 [illegible]	[illegible] 0.951	10.700 0.954	10.800 0.957	10.900 0.959	11.000 0.961	11.100 0.962
11.200 0.963	11.300 [illegible]	11.400 0.966	11.500 0.968	11.600 0.969	11.700 0.970	11.800 0.971	11.900 0.972
12.000 0.975	12.100 0.976	12.200 0.978	12.300 0.978	12.400 0.976	12.500 0.979	12.600 0.977	12.700 0.975
12.800 0.973	12.900 0.973	[illegible] 0.976	13.100 0.980	13.200 0.986	13.300 0.988	13.400 0.986	13.500 0.988
13.600 0.989							



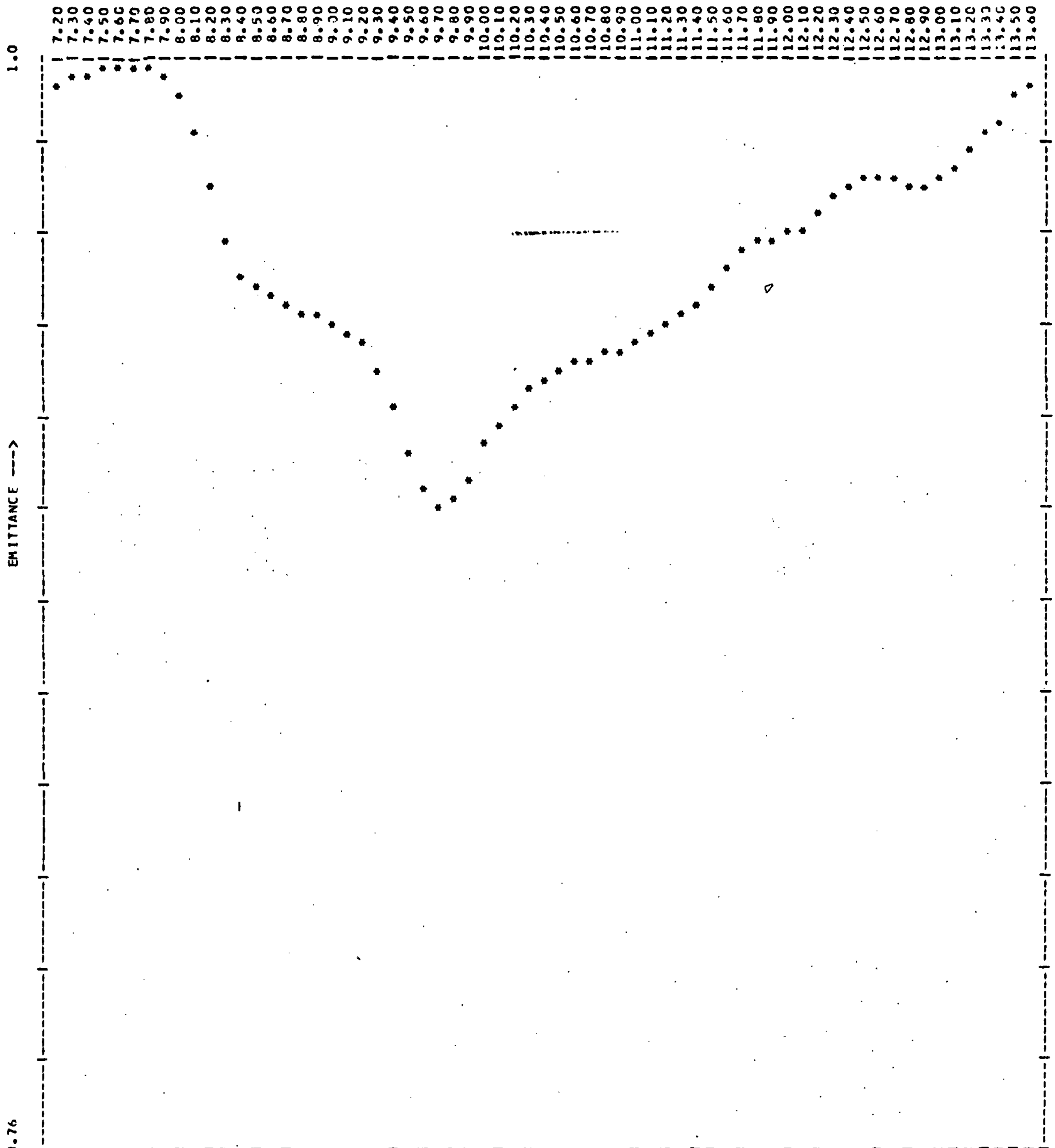
72 07 17 1220 PORPHYRITIC QUARTZ MONZONITE FROM TOPAZ LAKE CASE #331
YC=-0.300 CALIB. DIST.=-4.29 VOLTS PER INCH= 0.0695 OHMS= 451.70
INTERNAL REF. TEMPERATURE= 33.33 TARGET TEMPERATURE= 0.00
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 21.65
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.972	7.300 0.982	7.400 0.993	7.500 0.995	7.600 0.997	7.700 0.998	7.800 0.997	7.900 0.989
8.000 0.969	8.100 0.936	8.200 0.900	8.300 0.873	8.400 0.873	8.500 0.867	8.600 0.875	8.700 0.874
8.800 0.870	8.900 0.866	9.000 0.865	9.100 0.861	9.200 0.861	9.300 0.867	9.400 0.880	9.500 [illegible]
9.600 0.896	9.700 [illegible]	9.800 0.895	9.900 0.897	10.000 0.902	10.100 0.909	10.200 0.917	10.300 0.923
10.400 0.929	10.500 0.933	10.600 0.936	10.700 0.939	10.800 0.942	10.900 0.945	11.000 0.948	11.100 0.951
11.200 0.953	11.300 0.955	11.400 0.957	11.500 0.959	11.600 0.961	11.700 0.963	11.800 0.966	11.900 0.968
12.000 0.971	12.100 0.974	12.200 0.974	12.300 0.972	12.400 [illegible]	12.500 0.966	12.600 0.962	12.700 0.959
12.800 [illegible]	12.900 0.961	13.000 0.965	13.100 0.973	13.200 0.981	13.300 0.988	13.400 0.991	13.500 0.991
13.600 0.991							



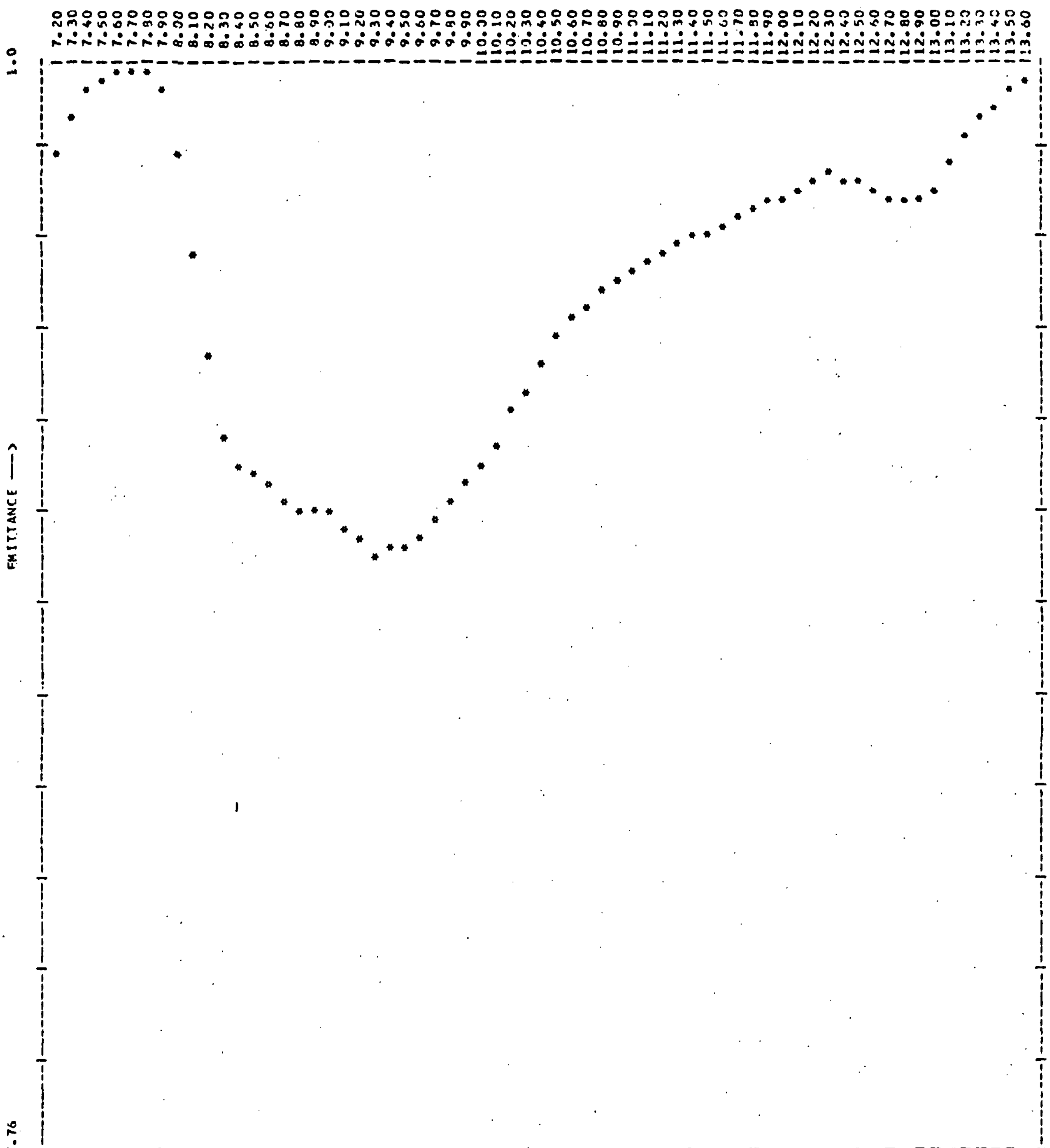
72 07 17   1450   BROWN BEAR PASS BASALT NASA #621 WEATHERD SURFACE
YC=-0.300   CALIB. DIST.=-6.16   VOLTS PER INCH= 0.0487   OHMS= 453.50
INTERNAL REF. TEMPERATURE= 34.49   TARGET TEMPERATURE= 35.50
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 34.01
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.985	7.300	0.989	7.400	0.994	7.500	0.996	7.600	0.999	7.700	0.999	7.800	0.999	7.900	0.997
8.000	0.995	8.100	0.992	8.200	0.988	8.300	0.985	8.400	0.982	8.500	0.979	8.600	0.977	8.700	0.974
8.800	0.971	8.900	0.970	9.000	0.968	9.100	0.965	9.200	0.961	9.300	0.955	9.400	0.947	9.500	0.940
9.600	0.936	9.700	0.936	9.800	0.940	9.900	0.943	10.000	0.948	10.100	0.953	10.200	0.957	10.300	0.961
10.400	0.964	10.500	0.966	10.600	0.967	10.700	0.969	10.800	0.969	10.900	0.970	11.000	0.970	11.100	0.971
11.200	0.972	11.300	0.973	11.400	0.974	11.500	0.975	11.600	0.977	11.700	0.978	11.800	0.979	11.900	0.980
12.000	0.981	12.100	0.981	12.200	0.983	12.300	0.984	12.400	0.986	12.500	0.987	12.600	0.988	12.700	0.988
12.800	0.988	12.900	0.987	13.000	0.988	13.100	0.990	13.200	0.993	13.300	0.996	13.400	0.999	13.500	1.000
13.600	0.999														



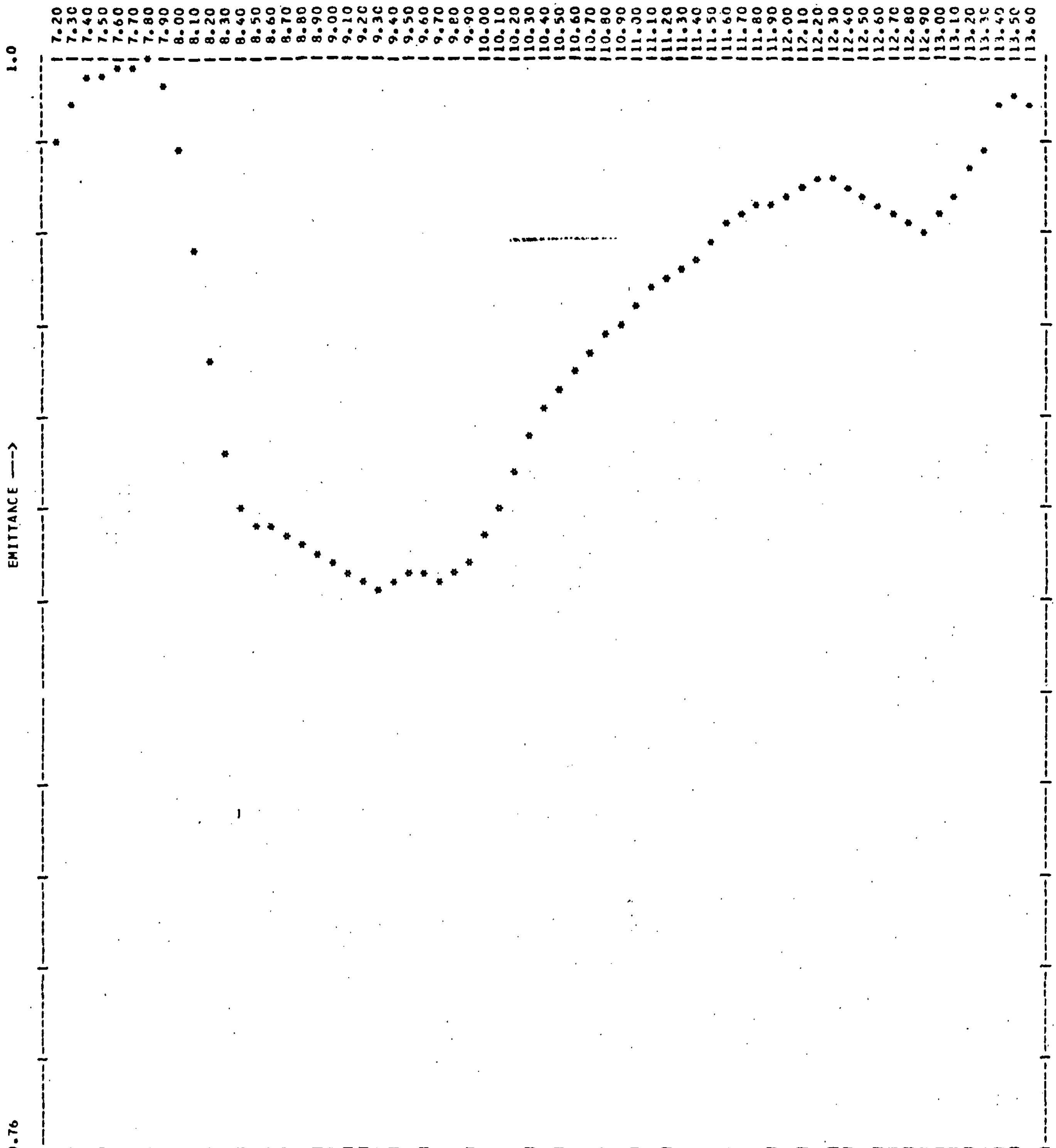
72 07 17 1500 BROWN BEAR PASSBASALT NASA #621 FRESH SURFACE (70% PLAGIOCLASE)
YC=-0.300 CALIB. DIST.=-6.19 VOLTS PER INCH= 0.0485 OHMS= 453.80
INTERNAL REF. TEMPERATURE= 34.69 TARGET TEMPERATURE= 35.50
WAVELENGTH OF EMIT. MAX.= 7.66
TARGET TEMPERATURE (SPECTROMETER) = 34.71
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.996	7.300 0.996	7.400 0.997	7.500 0.999	7.600 1.000	7.700 1.000	7.800 0.999	7.900 0.998
8.000 0.996	8.100 0.985	8.200 0.973	8.300 0.960	8.400 0.953	8.500 0.950	8.600 0.949	8.700 0.947
8.800 0.946	8.900 0.945	9.000 0.944	9.100 0.941	9.200 0.935	9.300 0.932	9.400 0.924	9.500 0.915
9.600 0.907	9.700 0.904	9.800 0.905	9.900 0.909	10.000 0.917	10.100 0.921	10.200 0.925	10.300 0.928
10.400 0.931	10.500 0.933	10.600 0.934	10.700 0.935	10.800 0.936	10.900 0.937	11.000 0.939	11.100 0.941
11.200 0.943	11.300 0.945	11.400 0.948	11.500 0.951	11.600 0.955	11.700 0.958	11.800 0.960	11.900 0.961
12.000 0.962	12.100 0.966	12.200 0.967	12.300 0.971	12.400 0.974	12.500 0.976	12.600 0.976	12.700 0.975
12.800 0.974	12.900 0.974	13.000 0.975	13.100 0.977	13.200 0.980	13.300 0.985	13.400 0.988	13.500 0.993
13.600 0.996							



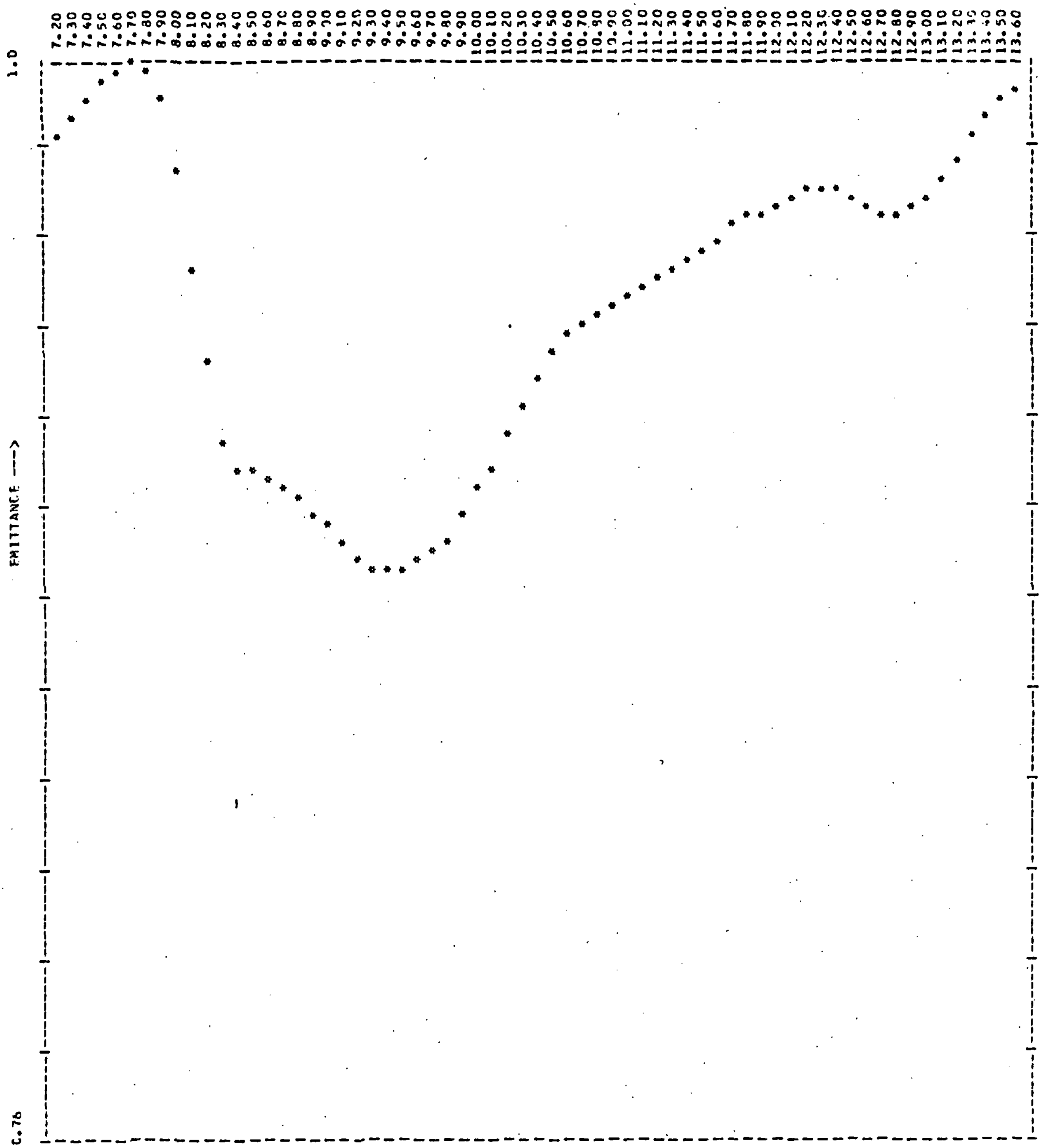
72 07 17 1595 CROW SPRINGS PORPHYRITIC QUARTS MUNZONITE C #8 ROUGH SURFACE
YC=-0.300 CALIB. DIST.=-5.00 VOLTS PER INCH= 0.0600 OHMS= 454.00
INTERNAL REF. TEMPERATURE= 34.82 TARGET TEMPERATURE= 34.50
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 33.53
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.980	7.300	0.989	7.400	0.995	7.500	0.996	7.600	0.998	7.700	0.999	7.800	1.000	7.900	0.994
8.000	0.981	8.100	0.959	8.200	0.934	8.300	0.919	8.400	0.913	8.500	0.910	8.600	0.910	8.700	0.906
8.800	0.903	8.900	0.903	9.000	0.903	9.100	0.899	9.200	0.896	9.300	0.893	9.400	0.895	9.500	0.896
9.600	0.897	9.700	0.901	9.800	0.905	9.900	0.909	10.000	0.913	10.100	0.918	10.200	0.924	10.300	0.930
10.400	0.935	10.500	0.940	10.600	0.945	10.700	0.948	10.800	0.950	10.900	0.952	11.000	0.954	11.100	0.956
11.200	0.959	11.300	0.961	11.400	0.963	11.500	0.964	11.600	0.965	11.700	0.968	11.800	0.970	11.900	0.971
12.000	0.972	12.100	0.973	12.200	0.976	12.300	0.976	12.400	0.976	12.500	0.974	12.600	0.972	12.700	0.971
12.800	0.970	12.900	0.971	13.000	0.974	13.100	0.979	13.200	0.985	13.300	0.989	13.400	0.992	13.500	0.995
13.600	0.996														



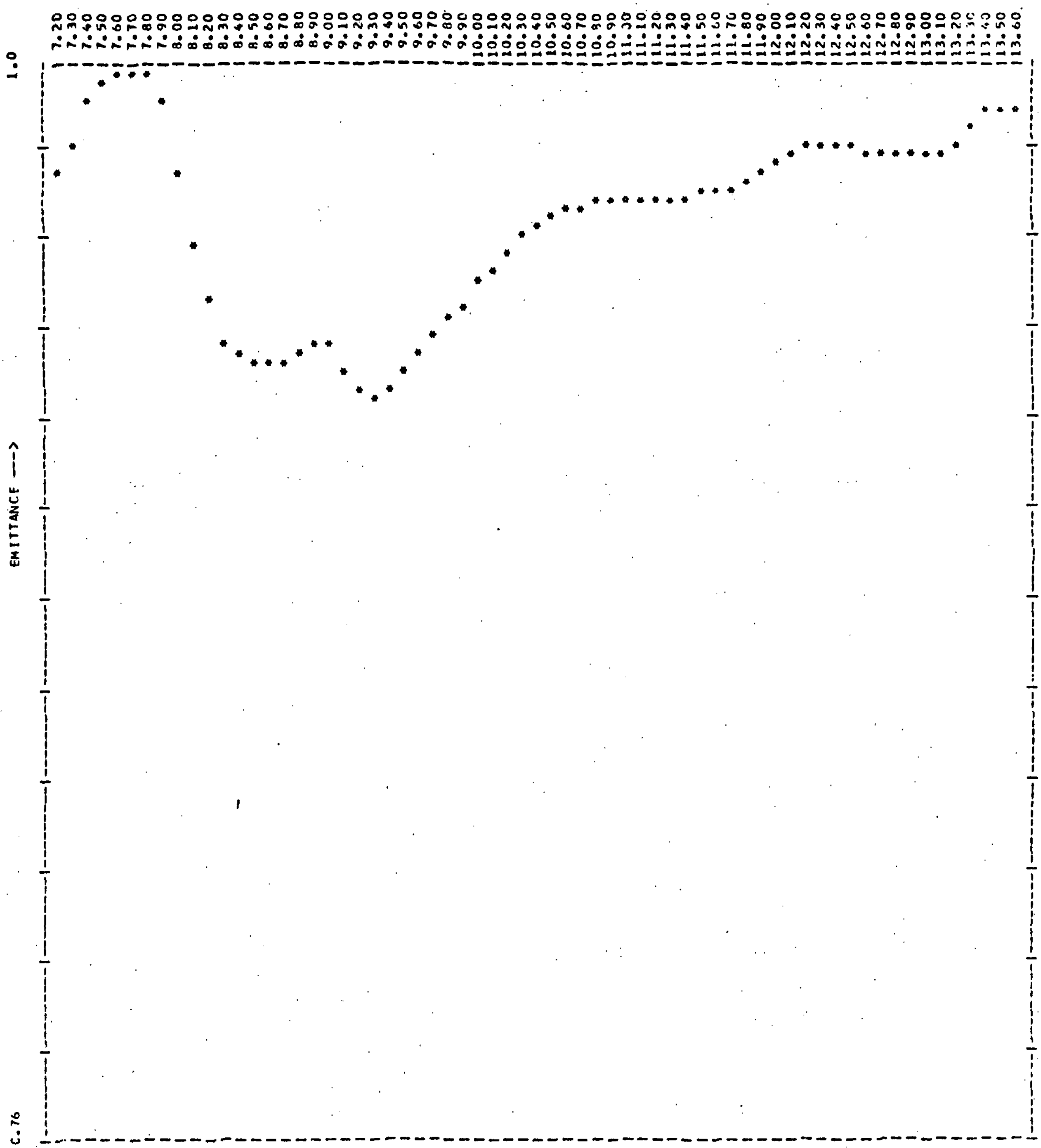
72 07 17 1515 CROW SPRINGS QUARTZ MONZONITE PORPHYRY Q #18 SAWED
YC=-0.300 CALIB. DIST.=-5.02 VOLTS PER INCH= 0.0598 OHMS= 454.30
INTERNAL REF. TEMPERATURE= 35.01 TARGET TEMPERATURE= 34.50
WAVELENGTH OF EMIT. MAX.= 7.77
TARGET TEMPERATURE (SPECTROMETER) = 36.25
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.984	7.300 0.993	7.400 0.997	7.500 0.998	7.600 0.999	7.700 1.000	7.800 1.000	7.900 0.995
8.000 0.980	8.100 0.959	8.200 0.934	8.300 0.914	8.400 0.903	8.500 0.900	8.600 0.899	8.700 0.898
8.800 0.895	8.900 0.892	9.000 0.892	9.100 0.888	9.200 0.886	9.300 0.886	9.400 0.887	9.500 0.889
9.600 0.889	9.700 0.888	9.800 0.890	9.900 0.892	10.000 0.896	10.100 0.903	10.200 0.911	10.300 0.919
10.400 0.925	10.500 0.930	10.600 0.934	10.700 0.937	10.800 0.940	10.900 0.944	11.000 0.947	11.100 0.950
11.200 0.953	11.300 0.955	11.400 0.958	11.500 0.961	11.600 0.964	11.700 0.967	11.800 0.968	11.900 0.969
12.000 0.971	12.100 0.973	12.200 0.975	12.300 0.974	12.400 0.973	12.500 0.971	12.600 0.969	12.700 0.966
12.800 0.964	12.900 0.962	13.000 0.967	13.100 0.971	13.200 0.977	13.300 0.982	13.400 0.991	13.500 0.993
13.600 0.991							



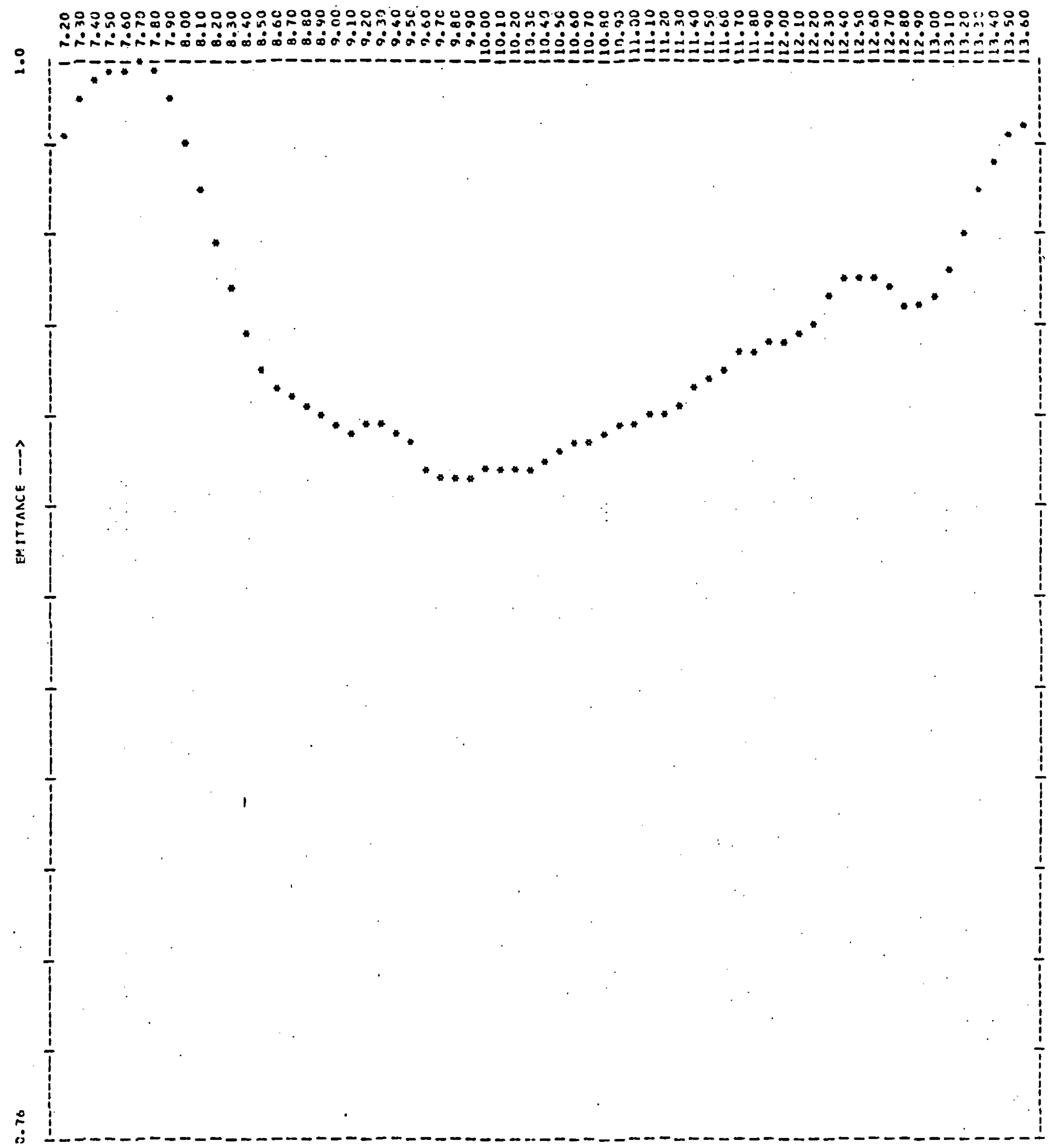
72 07 17 1525 CROW SPRINGS QUARTZ MONZONITE PORPHYRY C #18 ROUGH SURFACE
YC=-0.300 CALIB. DIST.=-5.01 VOLTS PER INCH= 0.0599 OHMS= 454.00
INTERNAL REF. TEMPERATURE= 34.42 TARGET TEMPERATURE= 36.0C
WAVELENGTH OF EMIT. MAX.= 7.62
TARGET TEMPERATURE (SPECTROMETER) = 35.88
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.985	7.300 0.989	7.400 0.993	7.500 0.998	7.600 0.999	7.700 1.000	7.800 0.998	7.900 0.992
8.000 0.977	8.100 0.956	8.200 0.934	8.300 0.918	8.400 0.910	8.500 0.910	8.600 0.909	8.700 0.907
8.800 0.904	8.900 0.902	9.000 0.900	9.100 0.895	9.200 0.890	9.300 0.889	9.400 0.889	9.500 0.890
9.600 0.891	9.700 0.892	9.800 0.896	9.900 0.900	10.000 0.906	10.100 0.912	10.200 0.919	10.300 0.925
10.400 0.932	10.500 0.937	10.600 0.940	10.700 0.943	10.800 0.945	10.900 0.947	11.000 0.949	11.100 0.950
11.200 0.952	11.300 0.955	11.400 0.957	11.500 0.959	11.600 0.962	11.700 0.964	11.800 0.966	11.900 0.967
12.000 0.969	12.100 0.971	12.200 0.973	12.300 0.974	12.400 0.973	12.500 0.972	12.600 0.970	12.700 0.968
12.800 0.967	12.900 0.969	13.000 0.972	13.100 0.975	13.200 0.979	13.300 0.985	13.400 0.989	13.500 0.993
13.600 0.995							



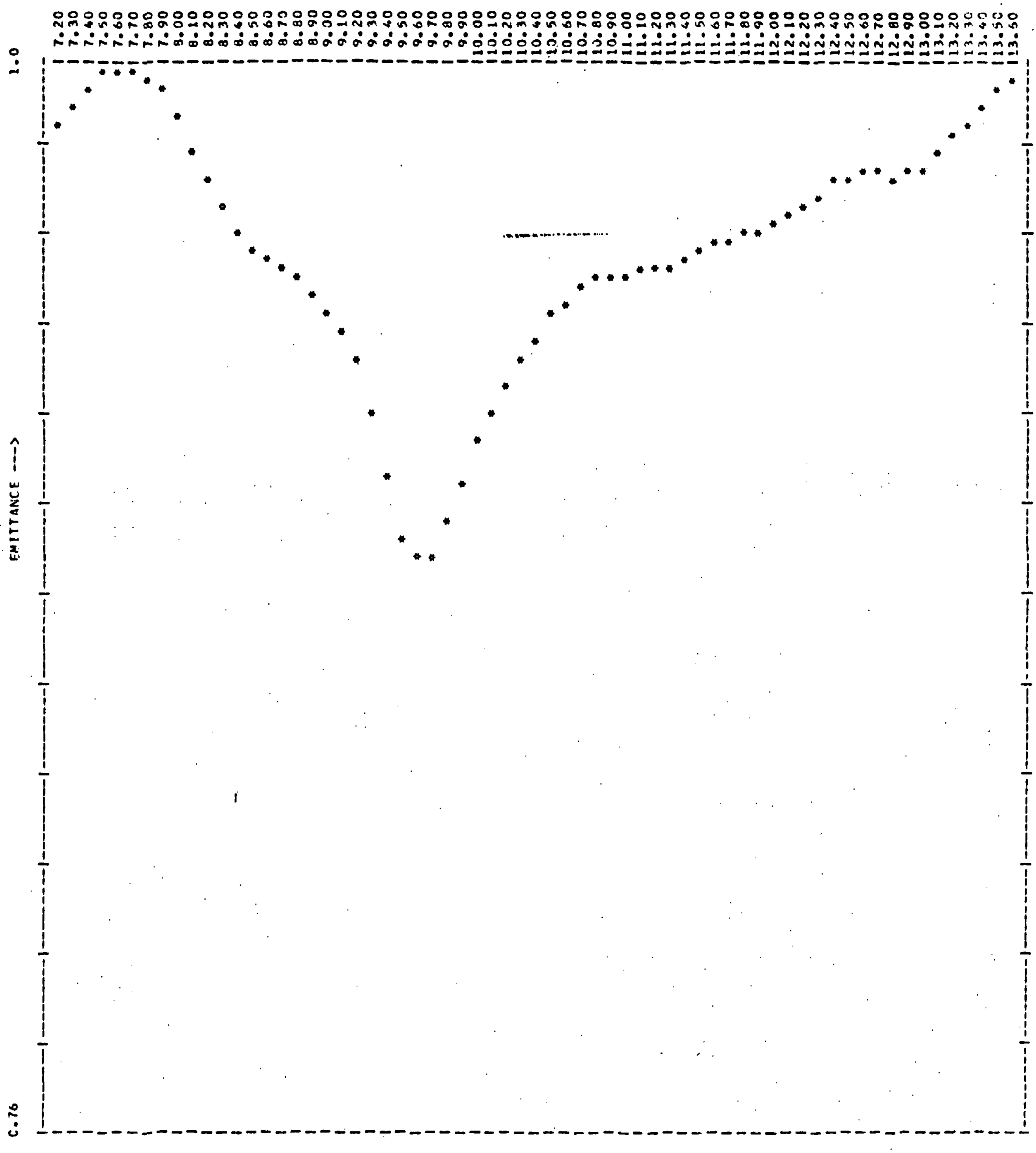
72 07 17 1530 CROW SPRINGS U #50 DEVITRIFIED ASH FLOW TUFF ROUGH SURFACE
YC=-0.300 CALIB. DIST.=-5.00 VOLTS PER INCH= 0.0600 OHMS= 454.00
INTERNAL REF. TEMPERATURE= 34.42 TARGET TEMPERATURE= 35.50
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTRUM-TEL) = 34.02
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.978	7.300 0.984	7.400 0.993	7.500 0.997	7.600 0.999	7.700 1.000	7.800 0.999	7.900 0.992
8.000 0.973	8.100 0.962	8.200 0.948	8.300 0.940	8.400 0.937	8.500 0.935	8.600 0.934	8.700 0.935
8.800 0.937	8.900 0.938	9.000 0.938	9.100 0.934	9.200 0.930	9.300 0.928	9.400 0.930	9.500 0.933
9.600 0.938	9.700 0.941	9.800 0.944	9.900 0.948	10.000 0.952	10.100 0.955	10.200 0.959	10.300 0.962
10.400 0.965	10.500 0.967	10.600 0.969	10.700 0.969	10.800 0.970	10.900 0.970	11.000 0.970	11.100 0.971
11.200 0.971	11.300 0.972	11.400 0.972	11.500 0.972	11.600 0.973	11.700 0.974	11.800 0.975	11.900 0.977
12.000 0.979	12.100 0.981	12.200 0.983	12.300 0.984	12.400 0.983	12.500 0.982	12.600 0.981	12.700 0.980
12.800 0.980	12.900 0.980	13.000 0.981	13.100 0.982	13.200 0.984	13.300 0.987	13.400 0.990	13.500 0.991
13.600 0.991							



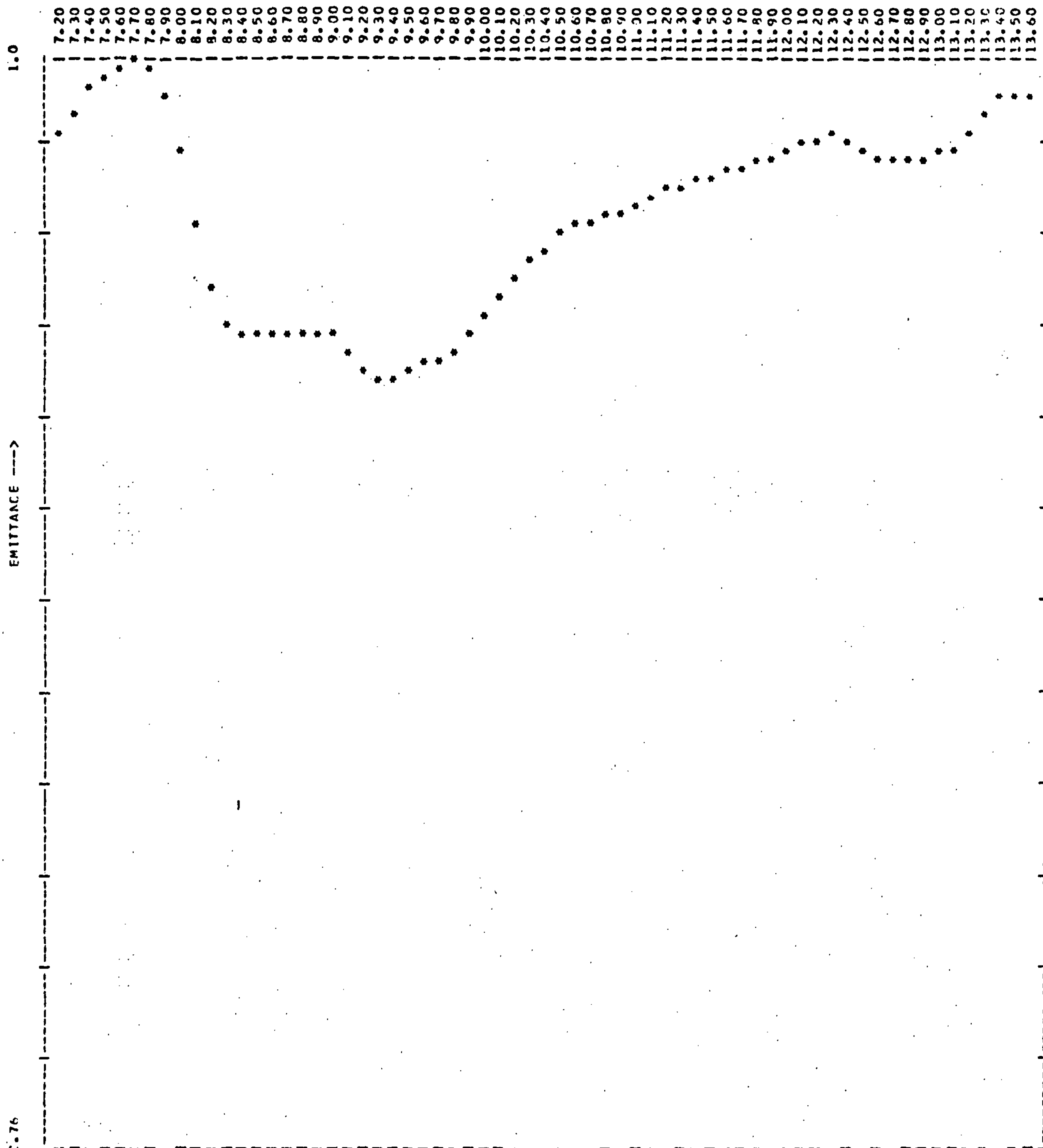
72 07 17   1539   CROW SPRINGS Q #71 FINE GRAINED WITH MICROLITE MATRIX
YC=-0.300   CALIB. DIST.=-6.15   VOLTS PER INCH= 0.0480   OHMS= 454.00
INTERNAL REF. TEMPERATURE= 34.82   TARGET TEMPERATURE= 37.50
WAVELENGTH OF EMIT. MAX.= 7.57
TARGET TEMPERATURE (SPECTROMETER) = 35.49
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.986	7.300 0.994	7.400 0.996	7.500 0.999	7.600 0.995	7.700 1.000	7.800 0.999	7.900 0.992
8.000 0.983	8.100 0.971	8.200 0.962	8.300 0.951	8.400 0.940	8.500 0.932	8.600 0.929	8.700 0.927
8.800 0.925	8.900 0.923	9.000 0.921	9.100 0.920	9.200 0.921	9.300 0.921	9.400 0.920	9.500 0.916
9.600 0.912	9.700 0.909	9.800 0.909	9.900 0.909	10.000 0.911	10.100 0.911	10.200 0.911	10.300 0.912
10.400 0.913	10.500 0.915	10.600 0.916	10.700 0.917	10.800 0.919	10.900 0.920	11.000 0.922	11.100 0.923
11.200 0.924	11.300 0.926	11.400 0.928	11.500 0.931	11.600 0.934	11.700 0.936	11.800 0.938	11.900 0.938
12.000 0.939	12.100 0.941	12.200 0.944	12.300 0.948	12.400 0.952	12.500 0.954	12.600 0.953	12.700 0.951
12.800 0.948	12.900 0.947	13.000 0.949	13.100 0.954	13.200 0.962	13.300 0.972	13.400 0.978	13.500 0.986
13.600 0.987							



72 07 17 1540 CROW SPRINGS 0 471 WEATHERED WITH MAGNETITE IRONSTAIN
YC=-0.300 CALIB. DIST.=-6.15 VOLTS PER INCH= 0.0488 OHMS= 454.00
INTERNAL REF. TEMPERATURE= 34.82 TARGET TEMPERATURE= 37.00
WAVELENGTH OF EMIT. MAX.= 7.62
TARGET TEMPERATURE (SPECTROMETER) = 35.41
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.987	7.300 0.992	7.400 0.996	7.500 0.999	7.600 0.999	7.700 0.999	7.800 0.998	7.900 0.995
8.000 0.989	8.100 0.982	8.200 0.975	8.300 0.968	8.400 0.963	8.500 0.960	8.600 0.956	8.700 0.955
8.800 0.952	8.900 0.948	9.000 0.946	9.100 0.941	9.200 0.935	9.300 0.922	9.400 0.908	9.500 0.896
9.600 0.890	9.700 0.892	9.800 0.899	9.900 0.906	10.000 0.916	10.100 0.923	10.200 0.929	10.300 0.935
10.400 0.940	10.500 0.944	10.600 0.948	10.700 0.951	10.800 0.953	10.900 0.953	11.000 0.954	11.100 0.954
11.200 0.955	11.300 0.955	11.400 0.957	11.500 0.958	11.600 0.960	11.700 0.961	11.800 0.963	11.900 0.964
12.000 0.965	12.100 0.966	12.200 0.969	12.300 0.972	12.400 0.974	12.500 0.976	12.600 0.976	12.700 0.976
12.800 0.976	12.900 0.976	13.000 0.978	13.100 0.980	13.200 0.984	13.300 0.988	13.400 0.991	13.500 0.994
13.600 0.998							

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72 C7 17   1545    CROW SPRINGS U #1 STRONGLY WELDED QUARTZ LATTICE   ROUGH SURFACE
YC=-C.300   CALIB. DIST.=-6.16   VOLTS PER INCH= 0.0487   OHMS= 454.20
INTERNAL REF. TEMPERATURE= 34.94   TARGET TEMPERATURE= 35.0C
WAVELENGTH OF EMIT. MAX.=  7.71
TARGET TEMPERATURE (SPECTROMETER) =  34.38
EMITTANCES AT SPECIFIC WAVELENGTHS
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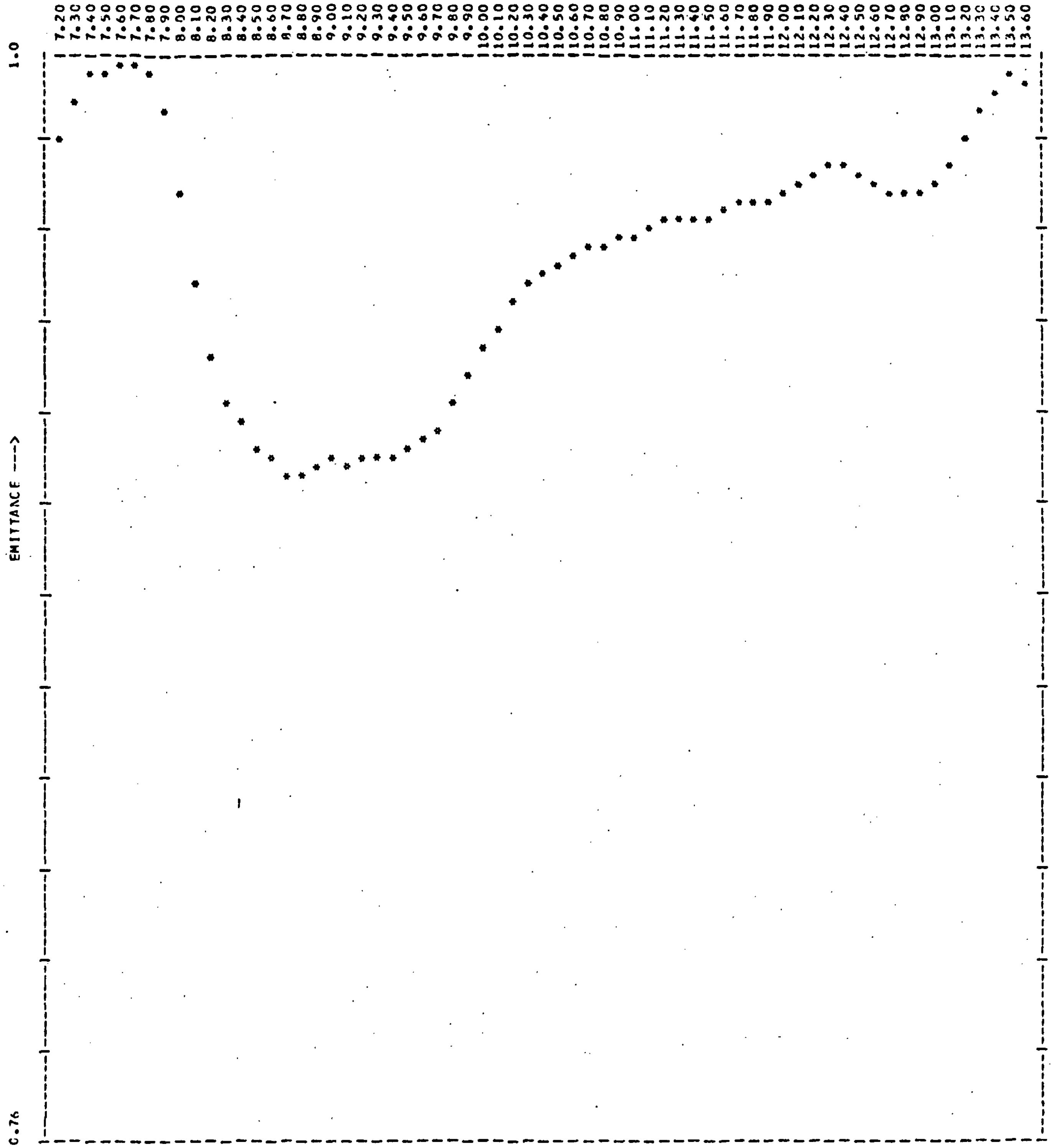
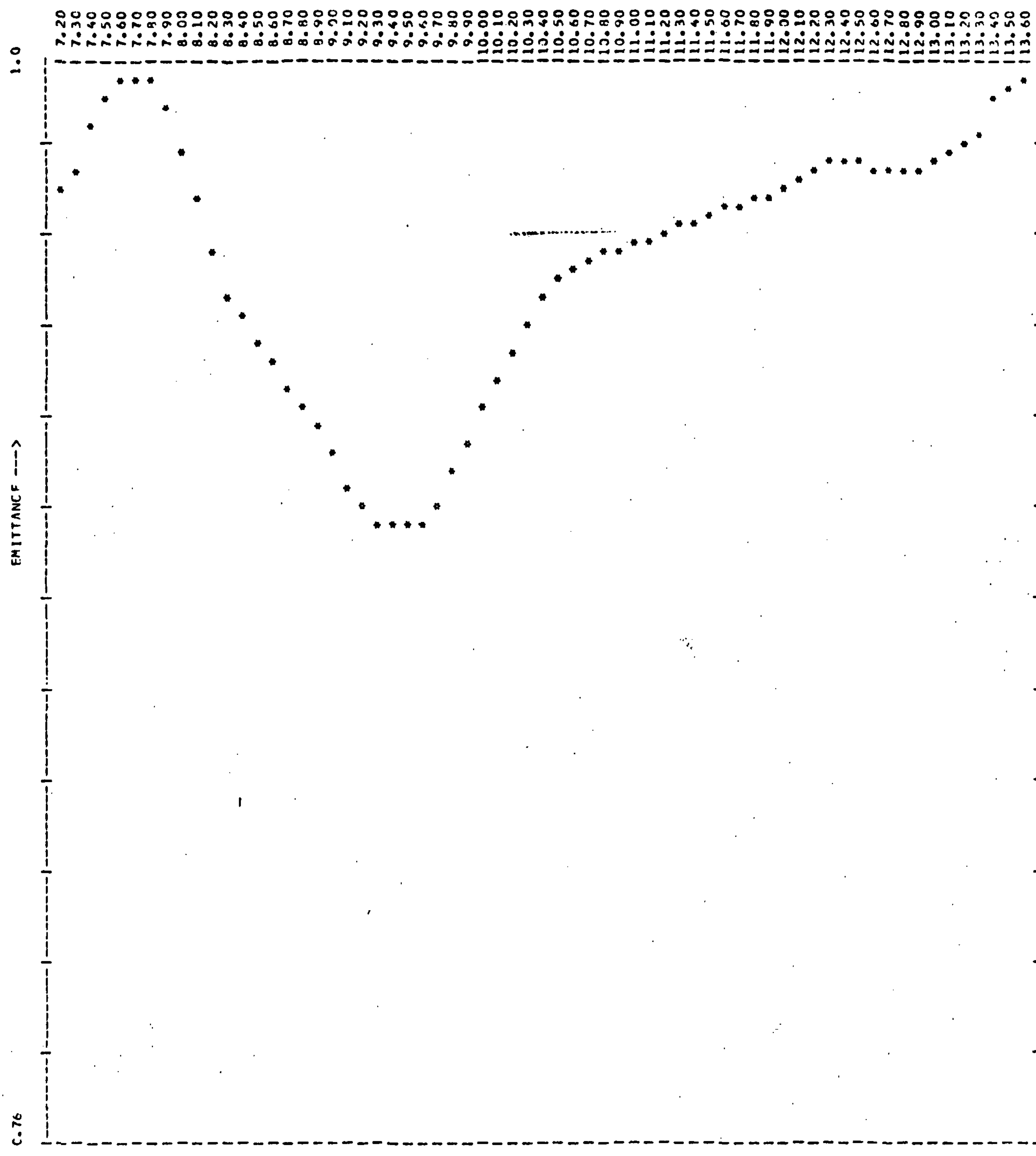
7.200 0.965	7.300 0.990	7.400 0.995	7.500 0.996	7.600 0.998	7.710 1.000	7.800 0.999	7.900 0.994
8.000 0.981	8.100 0.965	8.200 0.952	8.300 0.943	8.400 0.940	8.500 0.941	8.600 0.942	8.700 0.942
8.800 0.941	8.900 0.941	9.000 0.940	9.100 0.937	9.200 0.932	9.300 0.931	9.400 0.931	9.500 0.933
9.600 0.935	9.700 0.935	9.800 0.937	9.900 0.940	10.000 0.945	10.100 0.949	10.200 0.954	10.300 0.957
10.400 0.960	10.500 0.962	10.600 0.964	10.700 0.966	10.800 0.967	10.900 0.968	11.000 0.969	11.100 0.971
11.200 0.972	11.300 0.973	11.400 0.974	11.500 0.975	11.600 0.977	11.700 0.977	11.800 0.978	11.900 0.980
12.000 0.981	12.100 0.983	12.200 0.984	12.300 0.984	12.400 0.983	12.500 0.982	12.600 0.980	12.700 0.979
12.800 0.979	12.900 0.979	13.000 0.980	13.100 0.982	13.200 0.985	13.300 0.989	13.400 0.992	13.500 0.993
13.600 0.993							



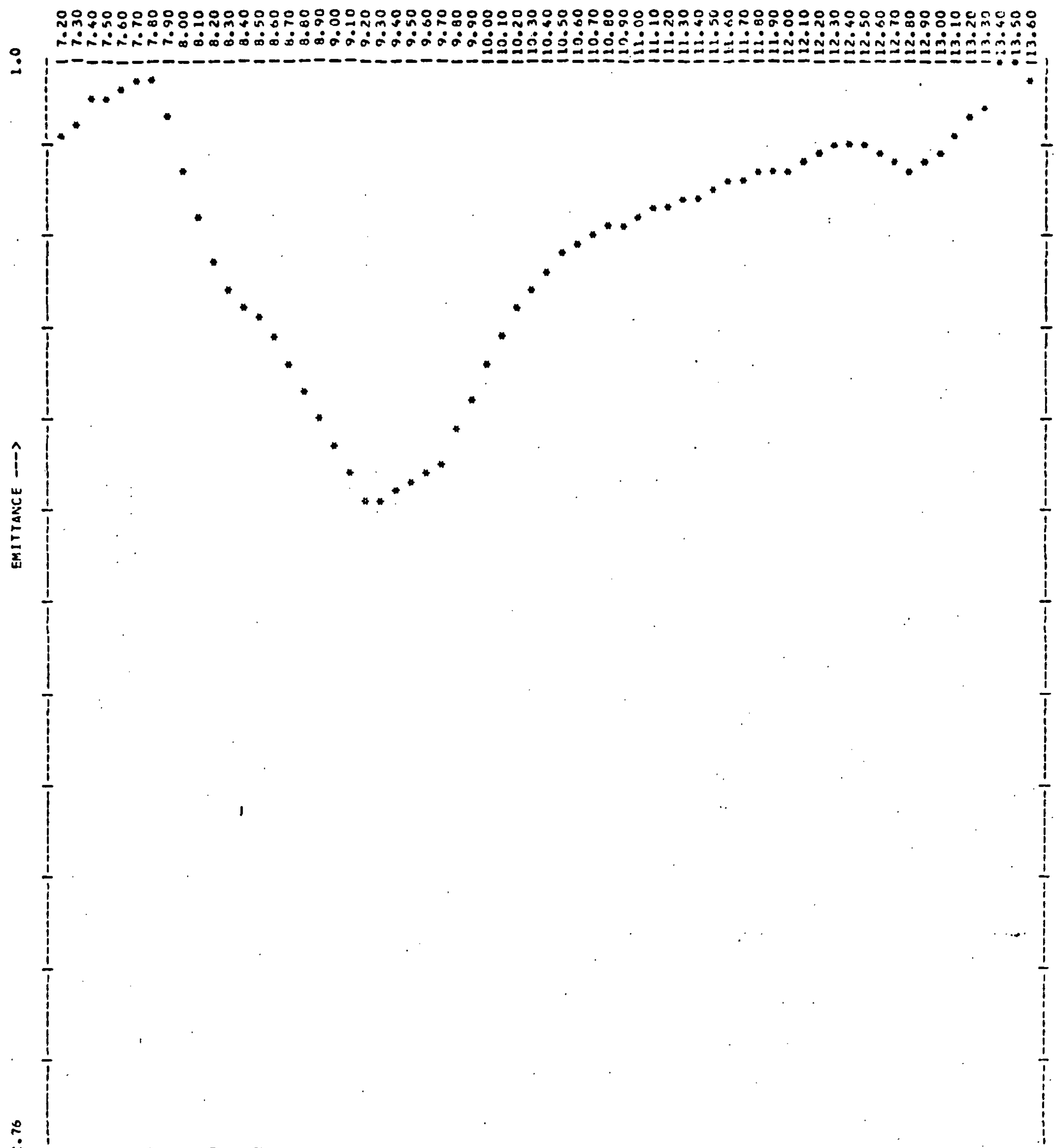
72 07 17 1550 NON-WELDED LITHIC TUFF (50% VOLCANIC DUST) ROUGH SURFACE C #61
YC=-0.300 CALIB. DIST.=-5.01 VOLTS PER INCH= 0.0599 OHMS= 454.29
INTERNAL REF. TEMPERATURE= 34.94 TARGET TEMPERATURE= 34.0C
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 32.91
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 [illegible]	7.300 [illegible]	7.400 0.996	7.500 0.997	7.600 0.998	7.700 1.000	7.800 0.998	7.900 [illegible]
8.000 0.972	8.100 0.952	8.200 0.936	8.300 0.926	8.400 0.920	8.500 0.915	8.600 0.912	8.700 0.909
8.800 0.905	8.900 0.910	9.000 0.912	9.100 0.912	9.200 0.913	9.300 0.912	9.400 0.914	9.500 0.915
9.600 0.917	9.700 0.920	9.800 0.925	9.900 0.930	10.000 0.937	10.100 0.941	10.200 0.947	10.300 0.951
10.400 0.954	10.500 0.955	10.600 0.957	10.700 0.958	10.800 0.959	10.900 0.960	11.000 0.961	11.100 0.963
11.200 0.964	11.300 0.965	11.400 0.965	11.500 0.965	11.600 0.967	11.700 0.968	11.800 0.969	11.900 0.969
12.000 0.970	12.100 0.972	12.200 0.974	12.300 0.976	12.400 0.977	12.500 0.975	12.600 0.973	12.700 0.971
12.800 0.970	12.900 0.971	13.000 0.973	13.100 0.977	13.200 0.982	13.300 0.989	13.400 0.993	13.500 0.997
13.600 [illegible]							



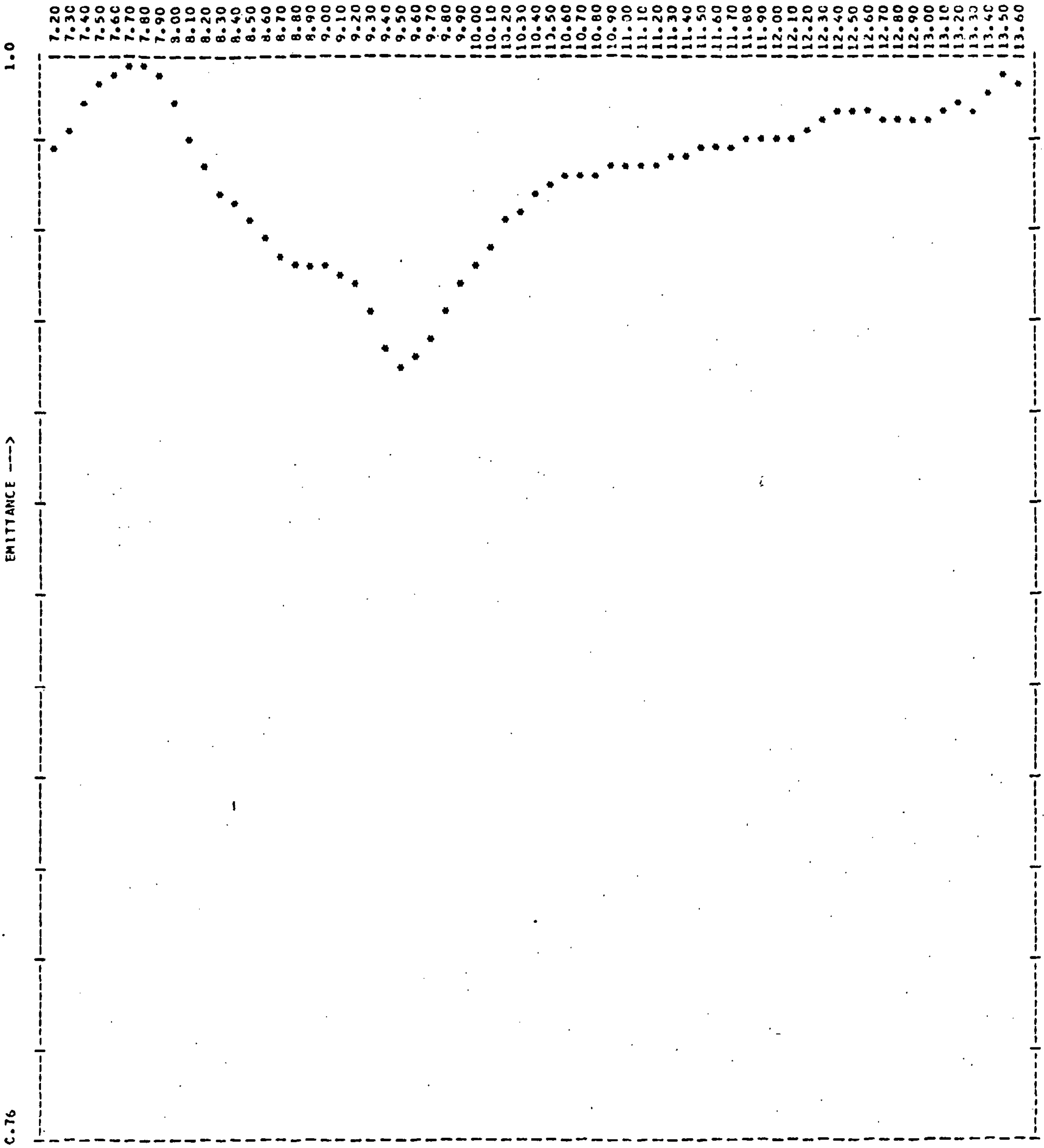
72 07 17 1605 WEATHERED VITROPHERE FILLED WITH GLASS FRAGMENTS 0 #77
YC=-0.300 CALIB. DIST.=-5.00 VOLTS PER INCH= 0.0600 OHMS= 454.20
INTERNAL REF. TEMPERATURE= 34.94 TARGET TEMPERATURE= 34.00
WAVELENGTH OF EMIT. MAX.= 7.73 .
TARGET TEMPERATURE (SPECTROMETER) = 33.22
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.974	7.300 0.976	7.400 0.987	7.500 0.992	7.600 0.997	7.700 0.998	7.800 0.997	7.900 0.991
8.000 0.982	8.100 0.970	8.200 0.959	8.300 0.950	8.400 0.944	8.500 0.939	8.600 0.935	8.700 0.930
8.800 0.925	8.900 0.920	9.000 0.914	9.100 0.907	9.200 0.903	9.300 0.900	9.400 0.900	9.500 0.899
9.600 0.903	9.700 0.906	9.800 0.911	9.900 0.917	10.000 0.925	10.100 0.931	10.200 0.938	10.300 0.944
10.400 0.949	10.500 0.952	10.600 0.955	10.700 0.957	10.800 0.958	10.900 0.959	11.000 0.960	11.100 0.962
11.200 0.963	11.300 0.965	11.400 0.966	11.500 0.967	11.600 0.968	11.700 0.969	11.800 0.971	11.900 0.972
12.000 0.974	12.100 0.976	12.200 0.977	12.300 0.979	12.400 0.980	12.500 0.979	12.600 0.977	12.700 0.977
12.800 0.976	12.900 0.976	13.000 0.978	13.100 0.980	13.200 0.984	13.300 0.986	13.400 0.993	13.500 0.996
13.600 0.996							



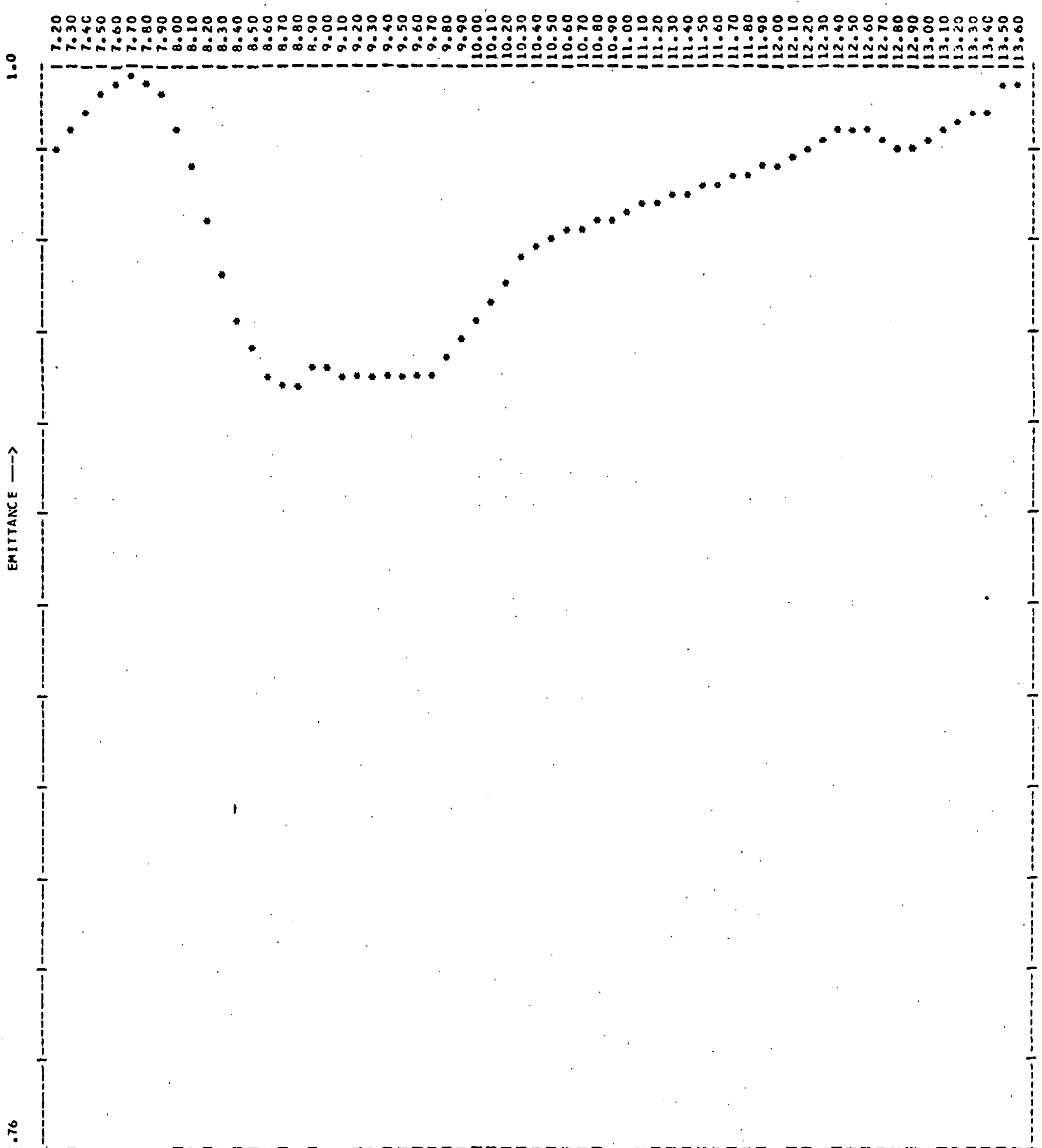
72 07 17 1610 NON-WEATHERED VITREPHERE 0 877
YC=-0.300 CALIB. DIST.=-5.02 VOLTS PER INCH= 0.0598 OHMS= 454.20
INTERNAL REF. TEMPERATURE= 34.04 TARGET TEMPERATURE= 34.00
WAVELENGTH OF EMIT. MAX.= 13.39
TARGET TEMPERATURE (SPECTROMETER) = 33.17
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.985	7.300	0.987	7.400	0.994	7.500	0.994	7.600	0.995	7.700	0.997	7.800	0.997	7.900	0.990
8.000	0.978	8.100	0.967	8.200	0.958	8.300	0.952	8.400	0.948	8.500	0.945	8.600	0.942	8.700	0.935
8.800	0.929	8.900	0.923	9.000	0.918	9.100	0.911	9.200	0.905	9.300	0.904	9.400	0.906	9.500	0.909
9.600	0.912	9.700	0.914	9.800	0.921	9.900	0.928	10.000	0.935	10.100	0.940	10.200	0.946	10.300	0.951
10.400	0.955	10.500	0.959	10.600	0.961	10.700	0.962	10.800	0.964	10.900	0.966	11.000	0.967	11.100	0.968
11.200	0.970	11.300	0.970	11.400	0.971	11.500	0.973	11.600	0.974	11.700	0.976	11.800	0.976	11.900	0.977
12.000	0.977	12.100	0.979	12.200	0.980	12.300	0.982	12.400	0.984	12.500	0.984	12.600	0.982	12.700	0.979
12.800	0.978	12.900	0.979	13.000	0.982	13.100	0.984	13.200	0.988	13.300	0.992	13.400	1.001	13.500	1.003
13.600	0.996														



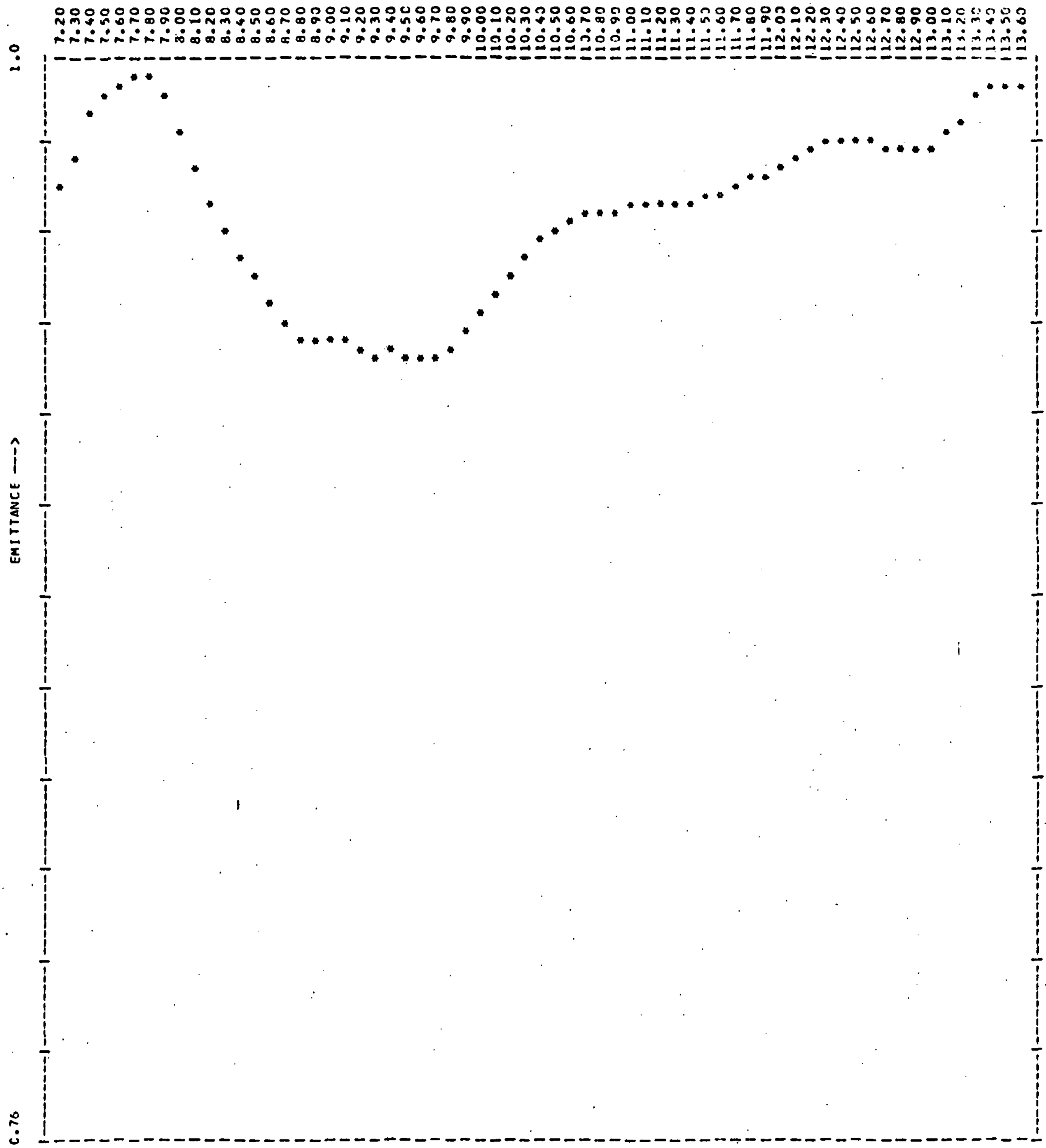
72 07 17   1715   CROW SPRINGS WELDED QUARTZ LATITE G #63 WEATHERD
YC=-0.300   CALIB. DIST.=-6.15   VOLTS PER INCH= 0.0488   OHMS= 454.20
INTERNAL REF. TEMPERATURE= 34.94   TARGET TEMPERATURE= 35.00
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 34.59
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	[illegible]	7.300	[illegible]	7.400	0.992	7.500	0.995	7.600	0.998	7.700	0.999	7.800	0.999	7.900	0.997
8.000	[illegible]	8.100	[illegible]	8.200	0.977	8.300	0.972	8.400	0.969	8.500	0.965	8.600	0.961	8.700	0.957
8.800	[illegible]	8.900	0.954	9.000	0.955	9.100	0.954	9.200	0.951	9.300	0.944	9.400	0.938	9.500	0.934
9.600	[illegible]	9.700	0.937	9.800	0.945	9.900	0.950	10.000	0.955	10.100	0.960	10.200	0.964	10.300	0.968
10.400	0.971	10.500	0.973	10.600	0.975	10.700	0.975	10.800	0.976	10.900	0.976	11.000	0.977	11.100	0.977
11.200	0.979	11.300	0.978	11.400	0.979	11.500	0.980	11.600	0.981	11.700	0.982	11.800	0.982	11.900	0.982
12.000	0.983	12.100	0.984	12.200	0.985	12.300	0.986	12.400	0.988	12.500	0.989	12.600	0.989	12.700	0.987
12.800	0.987	12.900	0.986	13.000	0.988	13.100	0.990	13.200	0.990	13.300	0.990	13.400	0.992	13.500	0.997
13.600	[illegible]														



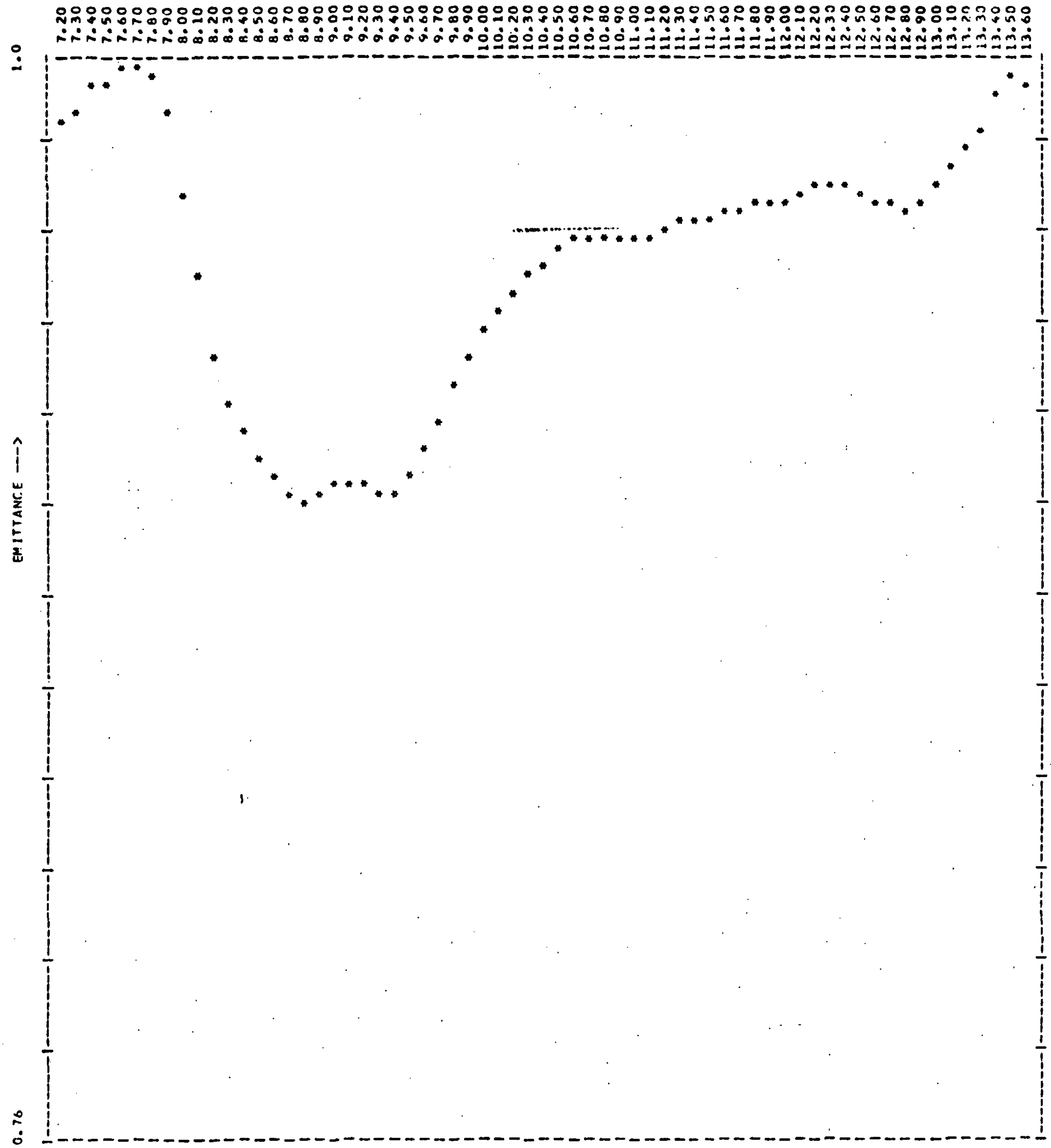
72 07 17 1420 CROW SPRINGS ALLUDED QUARTZ LATITE S#63 FRESH SURFACE
YC=-0.300 CALIB. DIST.=-6.18 VOLTS PER INCH= 0.0485 OHMS= 454.00
INTERNAL REF. TEMPERATURE= 34.42 TARGET TEMPERATURE= 35.00
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 34.33
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 [illegible]	7.300 0.987	7.400 0.992	7.500 0.995	7.600 0.998	7.700 0.999	7.800 0.998	7.900 0.994
8.000 0.989	8.100 0.978	8.200 0.967	8.300 0.955	8.400 0.946	8.500 0.939	8.600 0.933	8.700 0.931
8.800 [illegible]	8.900 0.935	9.000 0.935	9.100 0.933	9.200 0.933	9.300 0.933	9.400 0.934	9.500 0.934
9.600 0.932	9.700 0.933	9.800 0.937	9.900 0.941	10.000 0.946	10.100 0.950	10.200 0.954	10.300 0.958
10.400 0.961	10.500 0.963	10.600 0.964	10.700 0.965	10.800 0.966	10.900 0.968	11.000 0.969	11.100 0.970
11.200 0.971	11.300 0.973	11.400 0.973	11.500 0.975	11.600 0.976	11.700 0.977	11.800 0.978	11.900 0.979
12.000 0.980	12.100 0.982	12.200 0.983	12.300 0.985	12.400 0.986	12.500 0.987	12.600 0.987	12.700 0.985
12.800 0.985	12.900 0.983	13.000 0.984	13.100 0.987	13.200 0.989	13.300 0.992	13.400 0.992	13.500 0.997
13.600 0.996							



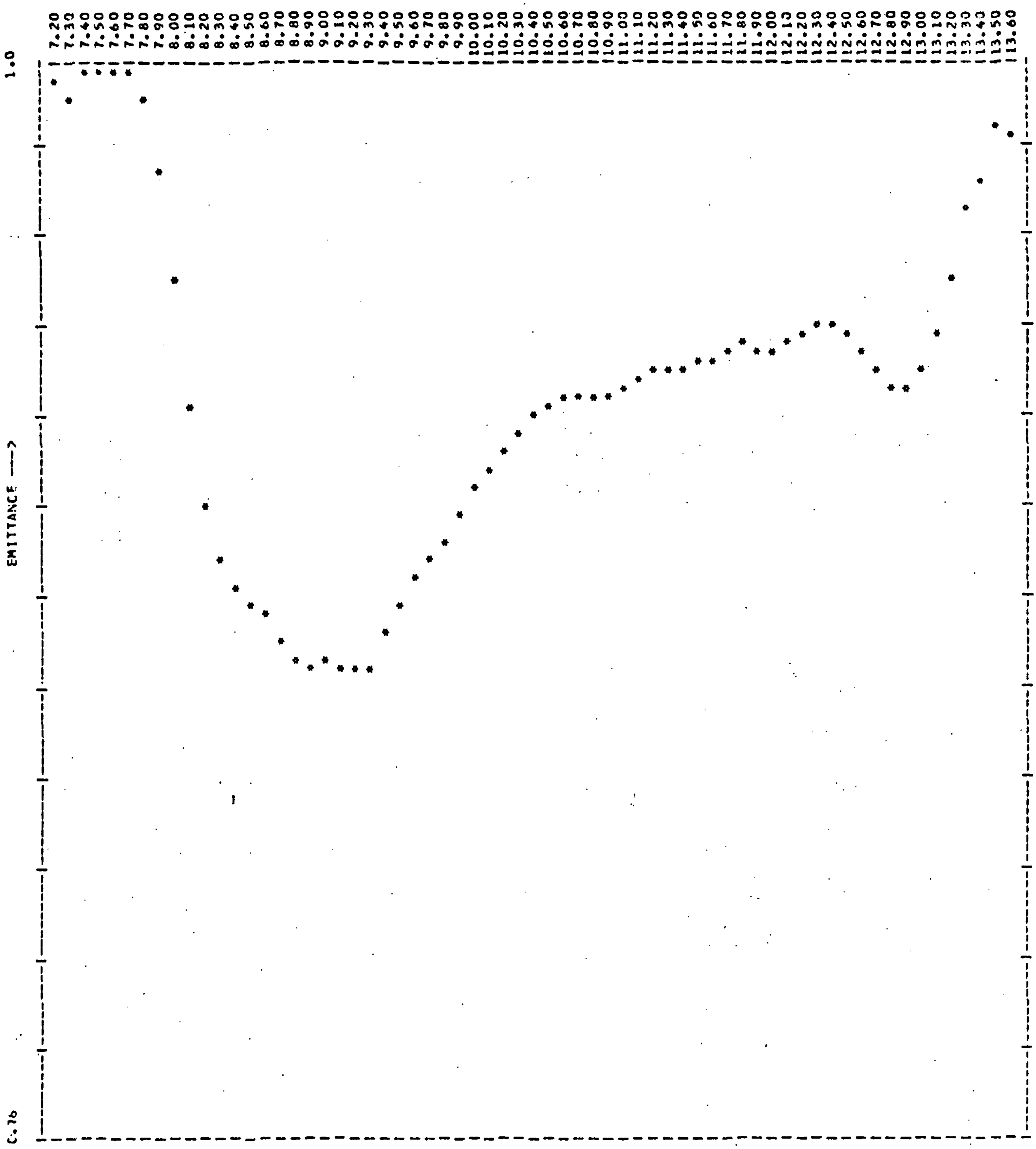
72 C7 17 1625 CROW SPRINGS STRONGLY ALTERD OBSIDIAN OR WELDED TUFF C#56 ROUGHSUR
YC=-0.300 CALIB. DIST.=-6.17 VOLTS PER INCH= 0.0486 OHMS= 454.00
INTERNAL REF. TEMPERATURE= 34.92 TARGET TEMPERATURE= 33.5C
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 32.69
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.973	7.300 0.980	7.400 0.990	7.500 0.993	7.600 0.996	7.700 0.998	7.800 0.998	7.900 0.993
8.000 0.984	8.100 0.976	8.200 0.969	8.300 0.963	8.400 0.958	8.500 0.952	8.600 0.948	8.700 0.942
8.800 0.939	8.900 0.939	9.000 0.939	9.100 0.938	9.200 0.938	9.300 0.936	9.400 0.936	9.500 0.936
9.600 0.935	9.700 0.935	9.800 0.937	9.900 0.941	10.000 0.946	10.100 0.950	10.200 0.953	10.300 0.957
10.400 0.961	10.500 0.964	10.600 0.966	10.700 0.966	10.800 0.967	10.900 0.968	11.000 0.968	11.100 0.968
11.200 0.969	11.300 0.969	11.400 0.969	11.500 0.970	11.600 0.972	11.700 0.974	11.800 0.975	11.900 0.976
12.000 0.977	12.100 0.979	12.200 0.981	12.300 0.983	12.400 0.984	12.500 0.984	12.600 0.982	12.700 0.981
12.800 0.983	12.900 0.981	13.000 0.982	13.100 0.984	13.200 0.988	13.300 0.993	13.400 0.994	13.500 0.994
13.600 [illegible]							



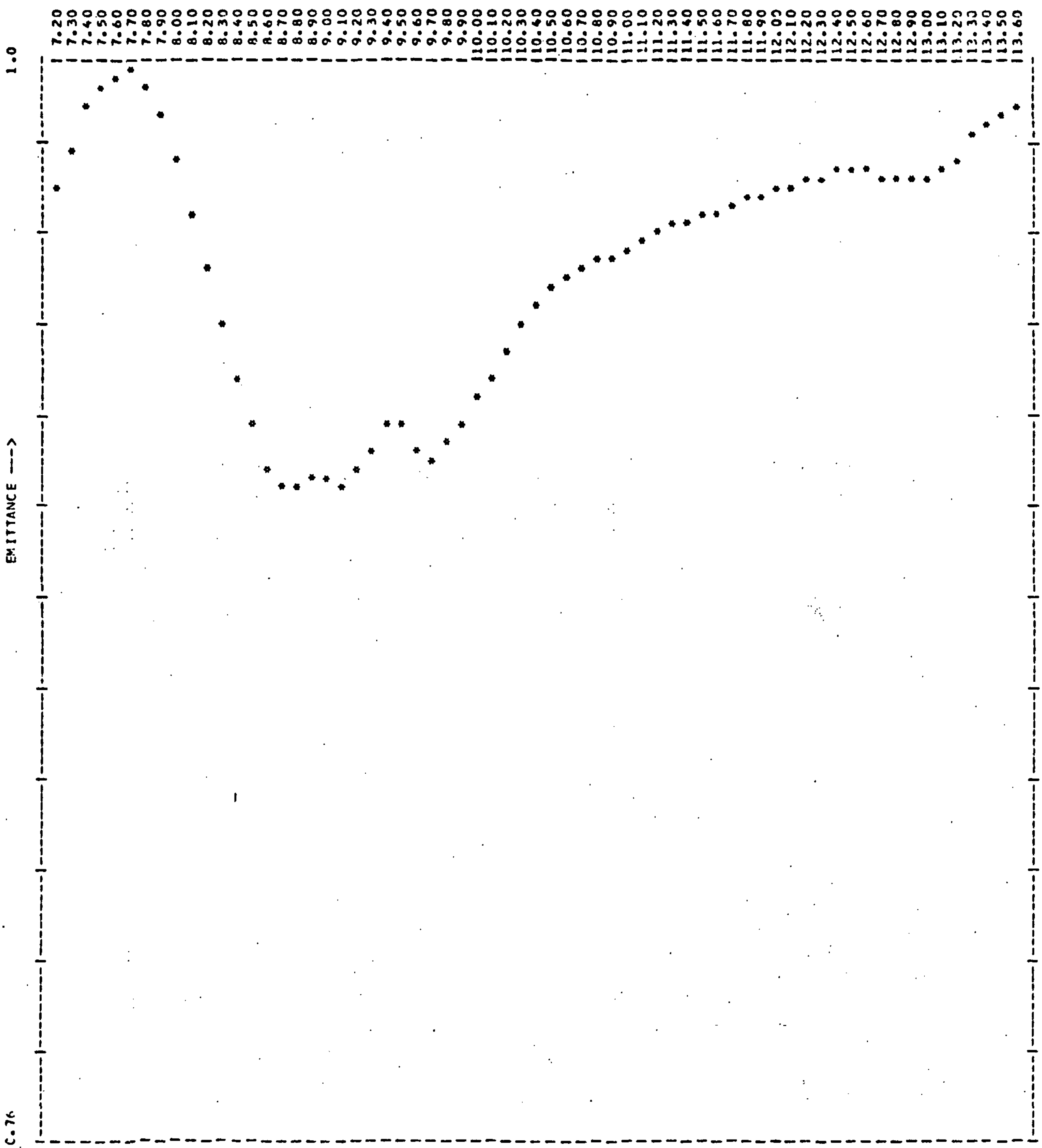
72 07 17 1635 CROW SPRINGS STRONGLY WELDED CRYSTAL TUFF Q#58 ROUGH SURFACE
YC=-0.300 CALIB. DIST.=-5.01 VOLTS PER INCH= 0.0599 OHMS= 453.80
INTERNAL REF. TEMPERATURE= 36.69 TARGET TEMPERATURE= 33.00
WAVELENGTH OF EMIT. MAX.= 7.68
TARGET TEMPERATURE (SPECTROMETER) = 32.20
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.988	7.300 0.989	7.400 0.995	7.500 0.996	7.600 0.998	7.700 0.999	7.800 0.998	7.900 0.987
8.000 0.972	8.100 0.952	8.200 0.935	8.300 0.924	8.400 0.918	8.500 0.914	8.600 0.910	8.700 0.905
8.800 0.903	8.900 0.905	9.000 0.907	9.100 0.907	9.200 0.906	9.300 0.904	9.400 0.906	9.500 0.910
9.600 0.915	9.700 0.922	9.800 0.929	9.900 0.934	10.000 0.940	10.100 0.944	10.200 0.949	10.300 0.952
10.400 0.956	10.500 0.958	10.600 0.960	10.700 0.961	10.800 0.960	10.900 0.960	11.000 0.961	11.100 0.962
11.200 0.963	11.300 0.964	11.400 0.965	11.500 0.965	11.600 0.966	11.700 0.967	11.800 0.968	11.900 0.969
12.000 0.969	12.100 0.971	12.200 0.973	12.300 0.973	12.400 0.973	12.500 0.971	12.600 0.969	12.700 0.968
12.800 0.967	12.900 0.969	13.000 0.972	13.100 0.977	13.200 0.982	13.300 0.986	13.400 0.992	13.500 0.998
13.600 0.996							



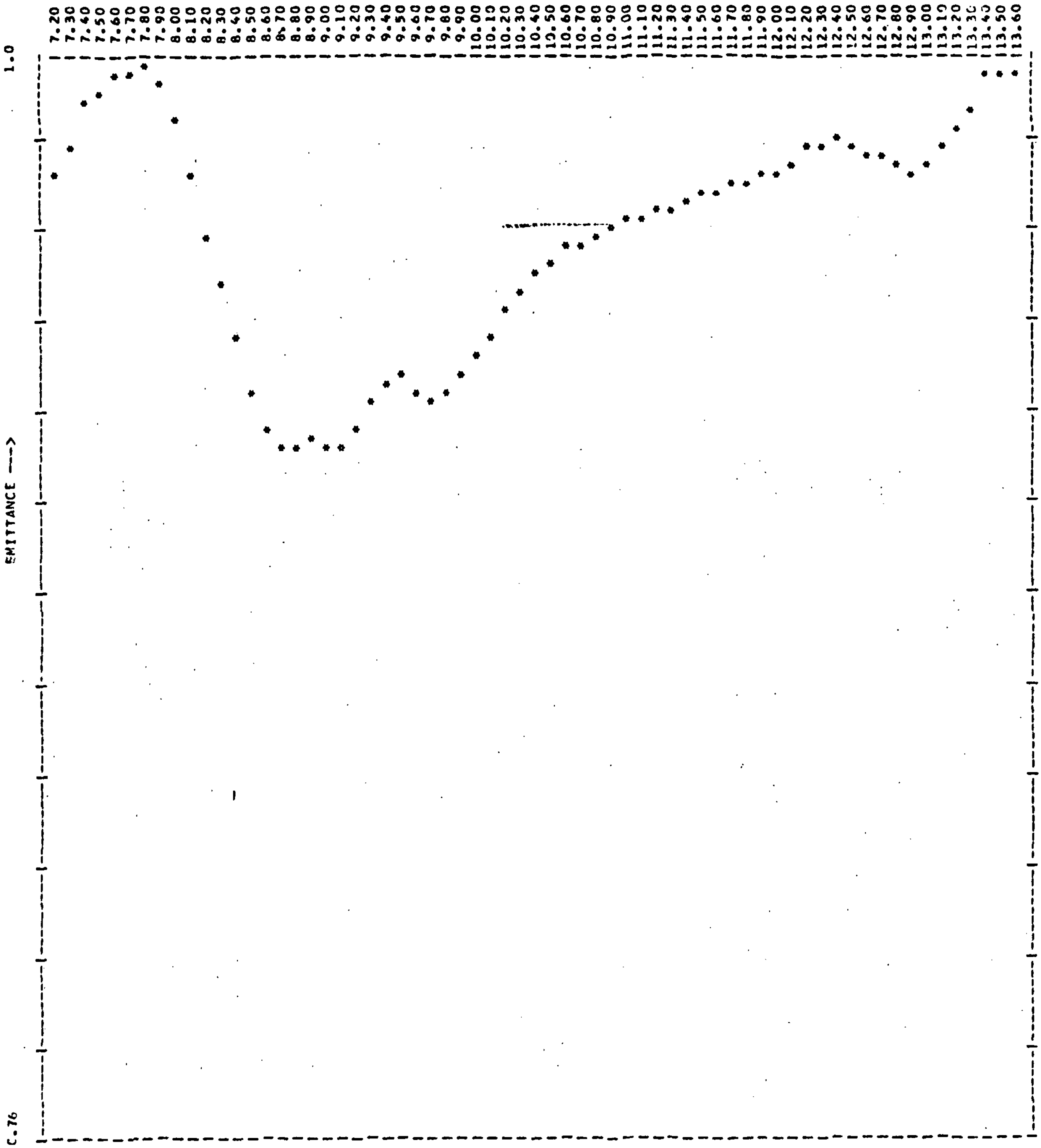
72 07 17 1640 CROW SPRINGS STRONGLY WELDED CRYSTAL TUFF Q#58 SAWED
YC=-0.300 CALIB. DIST.=-3.47 VOLTS PER INCH= 0.0865 OHMS= 453.80
INTERNAL REF. TEMPERATURE= 34.99 TARGET TEMPERATURE= 33.00
WAVELENGTH OF EMIT. MAX.= 7.55
TARGET TEMPERATURE (SPECTROMETER) = 31.51
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.997	7.300	0.983	7.400	0.998	7.500	0.998	7.600	0.998	7.700	0.998	7.800	0.994	7.900	0.978
8.000	0.953	8.100	0.926	8.200	0.903	8.300	0.891	8.400	0.885	8.500	0.881	8.600	0.879	8.700	0.873
8.800	0.868	8.900	0.867	9.000	0.869	9.100	0.868	9.200	0.877	9.300	0.867	9.400	0.874	9.500	0.882
9.600	0.888	9.700	0.893	9.800	0.895	9.900	0.906	10.000	0.907	10.100	0.911	10.200	0.915	10.300	0.918
10.400	0.922	10.500	0.925	10.600	0.927	10.700	0.927	10.800	0.927	10.900	0.928	11.000	0.929	11.100	0.930
11.200	0.933	11.300	0.933	11.400	0.933	11.500	0.934	11.600	0.937	11.700	0.937	11.800	0.938	11.900	0.937
12.000	0.937	12.100	0.940	12.200	0.941	12.300	0.943	12.400	0.944	12.500	0.941	12.600	0.937	12.700	0.932
12.800	0.928	12.900	0.930	13.000	0.933	13.100	0.942	13.200	0.953	13.300	0.969	13.400	0.976	13.500	0.988
13.600	0.984														



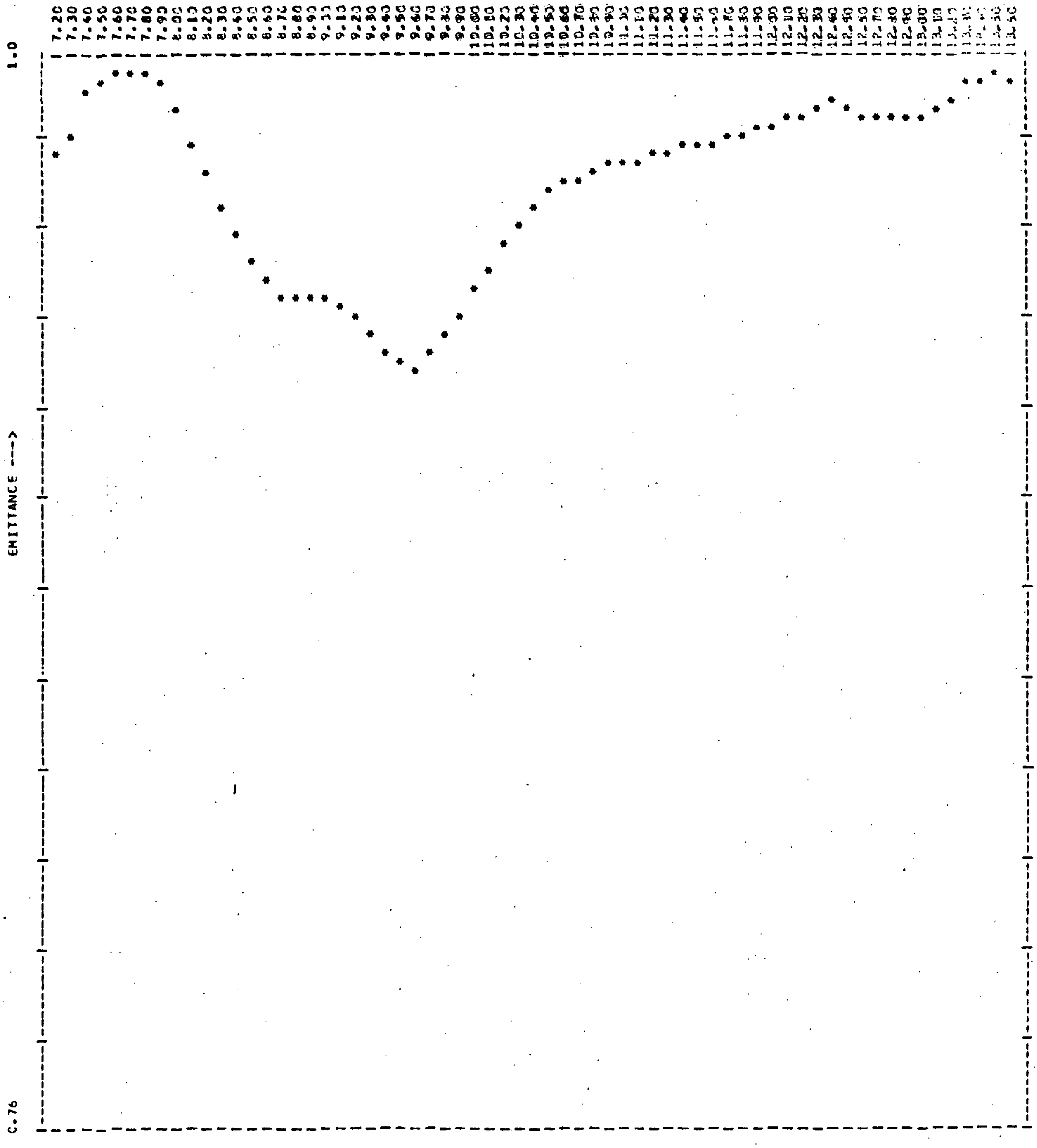
72 07 17 1645 CROW SPRINGS STRONGLY WELDED ASH FLOW TUFF C#70 WEATHERD
YC=-C.300 CALIB. DIST.=-5.03 VOLTS PER INCH= 0.0596 OHMS= 453.20
INTERNAL REF. TEMPERATURE= 34.30 TARGET TEMPERATURE= 33.5C
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 32.87
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.972	7.300 0.981	7.400 0.991	7.500 0.994	7.600 0.997	7.700 0.998	7.800 0.996	7.900 0.959
8.000 0.979	8.100 0.967	8.200 0.954	8.300 0.943	8.400 0.932	8.500 0.920	8.600 0.911	8.700 0.907
8.800 0.907	8.900 0.909	9.000 0.909	9.100 0.907	9.200 0.910	9.300 0.916	9.400 0.920	9.500 0.920
9.600 0.916	9.700 0.914	9.800 0.917	9.900 0.921	10.000 0.927	10.100 0.932	10.200 0.938	10.300 0.942
10.400 0.947	10.500 0.951	10.600 0.953	10.700 0.955	10.800 0.956	10.900 0.958	11.000 0.959	11.100 0.961
11.200 0.963	11.300 0.965	11.400 0.966	11.500 0.967	11.600 0.968	11.700 0.970	11.800 0.971	11.900 0.972
12.000 0.973	12.100 0.973	12.200 0.974	12.300 0.976	12.400 0.977	12.500 0.977	12.600 0.976	12.700 0.975
12.800 0.975	12.900 0.974	13.000 0.974	13.100 0.976	13.200 0.980	13.300 0.985	13.400 0.988	13.500 0.993
13.600 [illegible]							



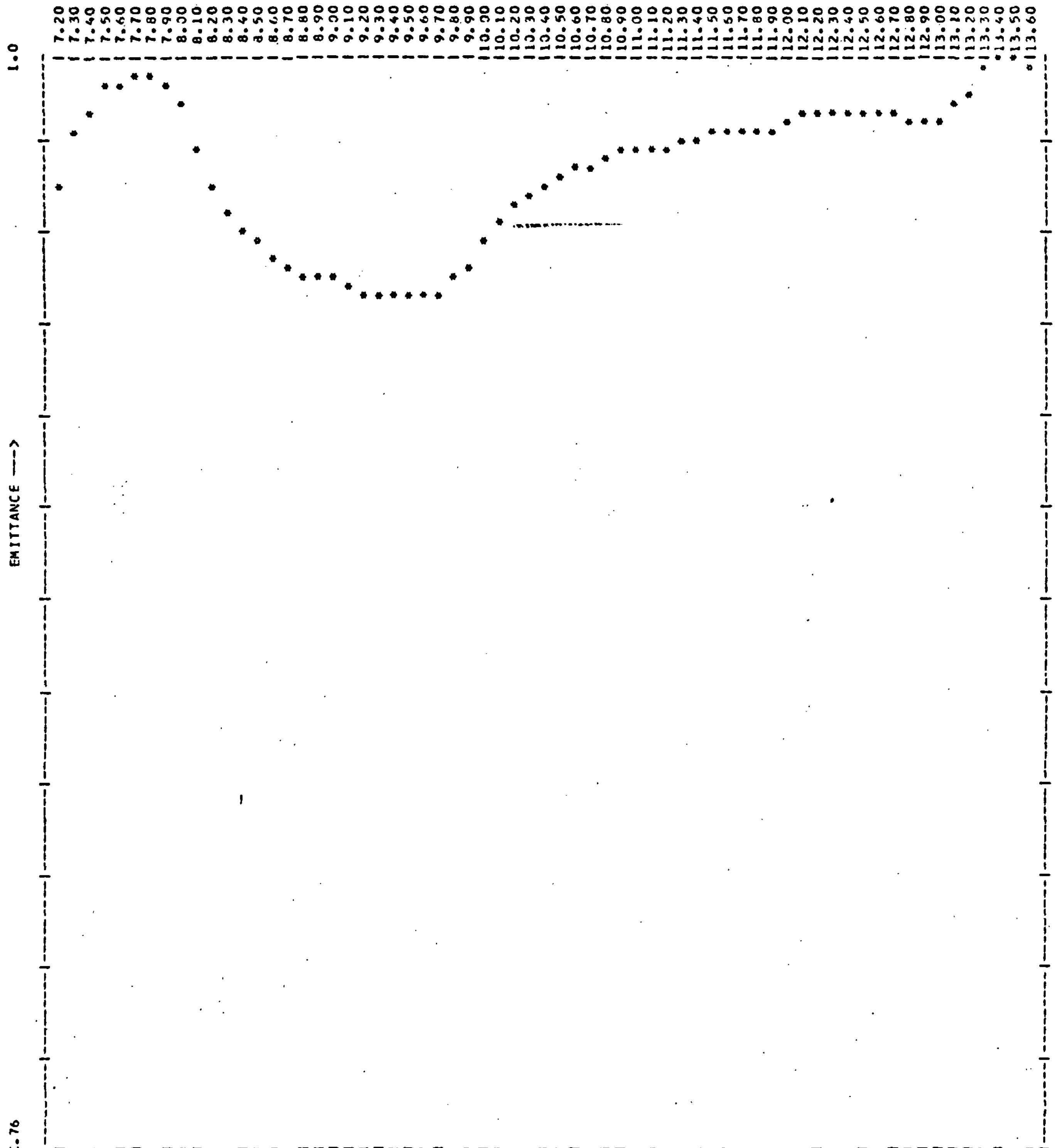
72 07 17   1655   CROW SPRINGS STRONGLY WELDED ASH FLOW TUFF Q470 FRESH SURFACE
YC=-0.300   CALIB. DIST.=-5.00   VOLTS PER INCH= 0.0600   OHMS= 453.00
INTERNAL REF. TEMPERATURE= 34.17   TARGET TEMPERATURE= 37.50
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 32.20
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.976	7.300 0.982	7.400 0.992	7.500 0.993	7.600 0.996	7.700 0.998	7.800 0.999	7.900 0.995
8.000 0.986	8.100 0.976	8.200 0.961	8.300 0.950	8.400 0.939	8.500 0.928	8.600 0.920	8.700 0.915
8.800 0.915	8.900 0.916	9.000 0.915	9.100 0.915	9.200 0.915	9.300 0.925	9.400 0.930	9.500 0.931
9.600 0.928	9.700 0.925	9.800 0.927	9.900 0.930	10.000 0.935	10.100 0.940	10.200 0.945	10.300 0.949
10.400 0.953	10.500 0.956	10.600 0.958	10.700 0.960	10.800 0.961	10.900 0.963	11.000 0.965	11.100 0.966
11.200 0.966	11.300 0.967	11.400 0.969	11.500 0.970	11.600 0.971	11.700 0.972	11.800 0.973	11.900 0.974
12.000 0.977	12.100 0.978	12.200 0.980	12.300 0.982	12.400 0.982	12.500 0.981	12.600 0.979	12.700 0.978
12.800 0.976	12.900 0.976	13.000 0.977	13.100 0.980	13.200 0.985	13.300 0.989	13.400 0.996	13.500 0.997
13.600 0.996							



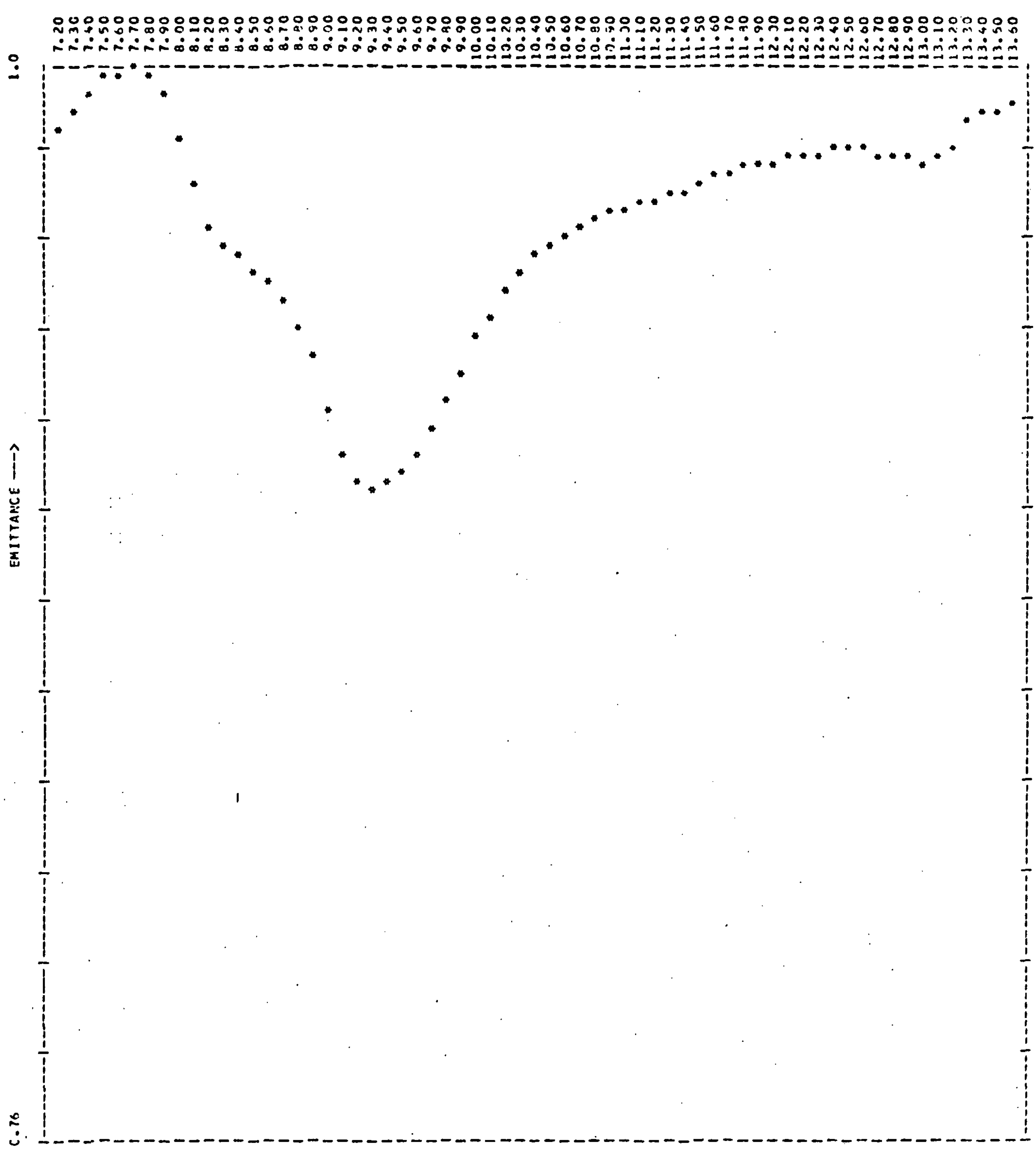
72 CT 17 1750 CROW SPRINGS J#55A WELDED CRYSTAL LITHIC TUFF WEATHERED
YC=-0.300 CALIB. DIST.=-6.14 VOLTS PER INCH= 0.0489 OHMS= 453.00
INTERNAL REF. TEMPERATURE= 34.17 TARGET TEMPERATURE= 32.50
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 31.25
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.978	7.300 0.983	7.400 0.992	7.500 0.995	7.600 0.997	7.700 0.997	7.800 0.998	7.900 0.995
8.000 0.989	8.100 0.982	8.200 0.974	8.300 0.967	8.400 0.962	8.500 0.956	8.600 0.952	8.700 0.947
8.800 0.944	8.900 0.947	9.000 0.947	9.100 0.945	9.200 0.943	9.300 0.938	9.400 0.935	9.500 0.933
9.600 0.931	9.700 0.934	9.800 0.939	9.900 0.943	10.000 0.949	10.100 0.954	10.200 0.959	10.300 0.963
10.400 0.967	10.500 0.971	10.600 0.973	10.700 0.974	10.800 0.975	10.900 0.976	11.000 0.977	11.100 0.978
11.200 0.979	11.300 0.980	11.400 0.981	11.500 0.981	11.600 0.981	11.700 0.982	11.800 0.983	11.900 0.984
12.000 0.985	12.100 0.987	12.200 0.988	12.300 0.989	12.400 0.990	12.500 0.989	12.600 0.988	12.700 0.987
12.800 0.987	12.900 0.987	13.000 0.988	13.100 0.989	13.200 0.991	13.300 0.994	13.400 0.995	13.500 0.998
13.600 0.996							



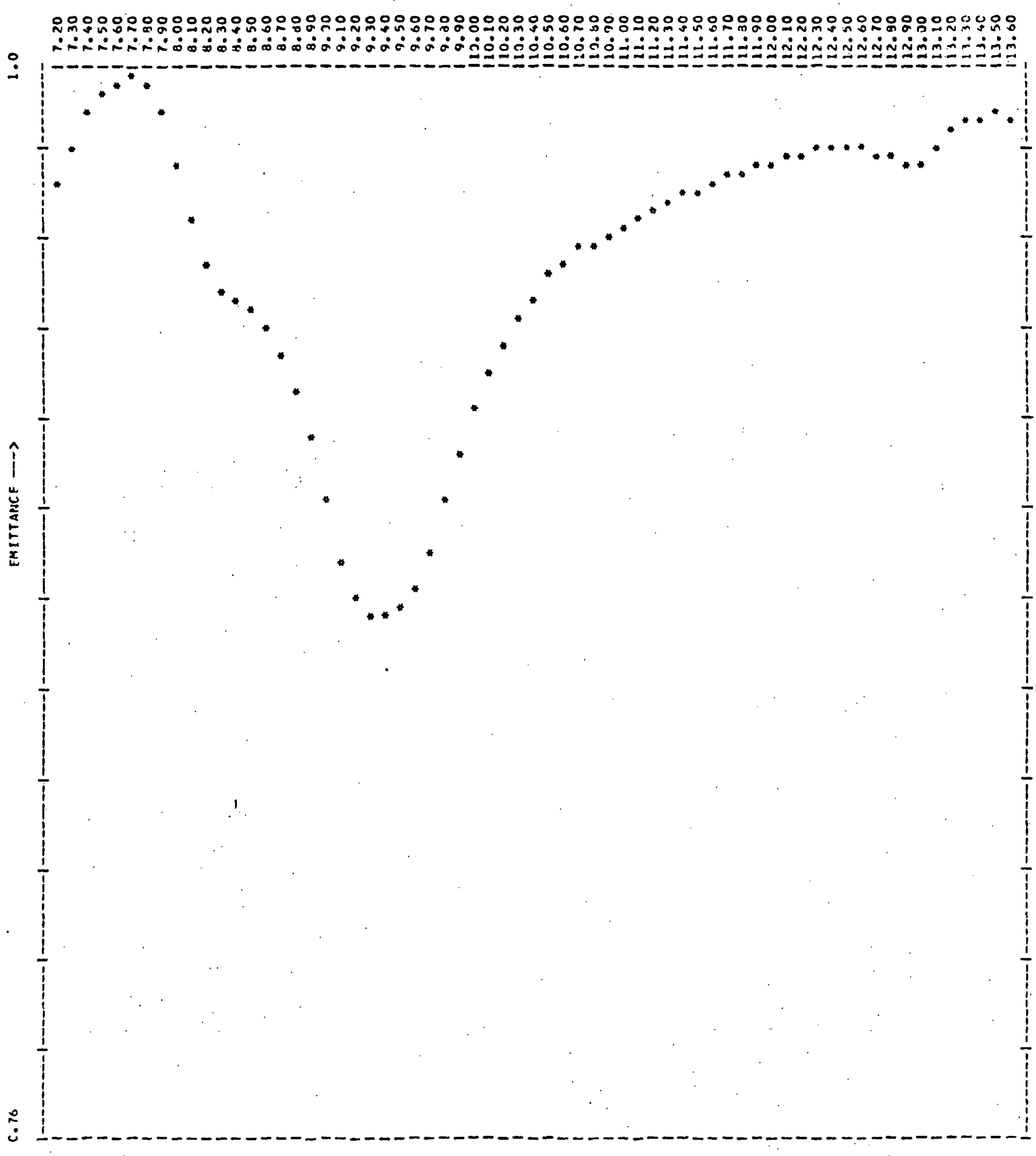
72 07 17   1600   CROW SPRINGS WA55A WELDED CRYSTAL LITHIC TUFF SAWED
YC=-0.300   CALIB. DIST.=-6.16   VOLTS PER INCH= 0.0487   OHMS= 453.00
INTERNAL REF. TEMPERATURE= 34.17   TARGET TEMPERATURE= 32.50
WAVELENGTH OF EMIT. MAX.= 13.39
TARGET TEMPERATURE (SPECTROMETER) = 31.00
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.973	7.300	0.986	7.400	0.989	7.500	0.994	7.600	0.995	7.700	0.997	7.800	0.997	7.900	0.996
8.000	0.991	8.100	0.982	8.200	0.973	8.300	0.967	8.400	0.963	8.500	0.960	8.600	0.958	8.700	0.955
8.800	0.953	8.900	0.952	9.000	0.952	9.100	0.951	9.200	0.950	9.300	0.949	9.400	0.950	9.500	0.950
9.600	0.949	9.700	0.950	9.800	0.952	9.900	0.956	10.000	0.961	10.100	0.965	10.200	0.968	10.300	0.971
10.400	0.973	10.500	0.975	10.600	0.976	10.700	0.978	10.800	0.979	10.900	0.980	11.000	0.980	11.100	0.980
11.200	0.981	11.300	0.983	11.400	0.984	11.500	0.984	11.600	0.985	11.700	0.985	11.800	0.985	11.900	0.986
12.000	0.987	12.100	0.988	12.200	0.989	12.300	0.989	12.400	0.989	12.500	0.990	12.600	0.989	12.700	0.988
12.800	0.987	12.900	0.987	13.000	0.988	13.100	0.990	13.200	0.993	13.300	0.999	13.400	1.000	13.500	1.003
13.600	1.000														



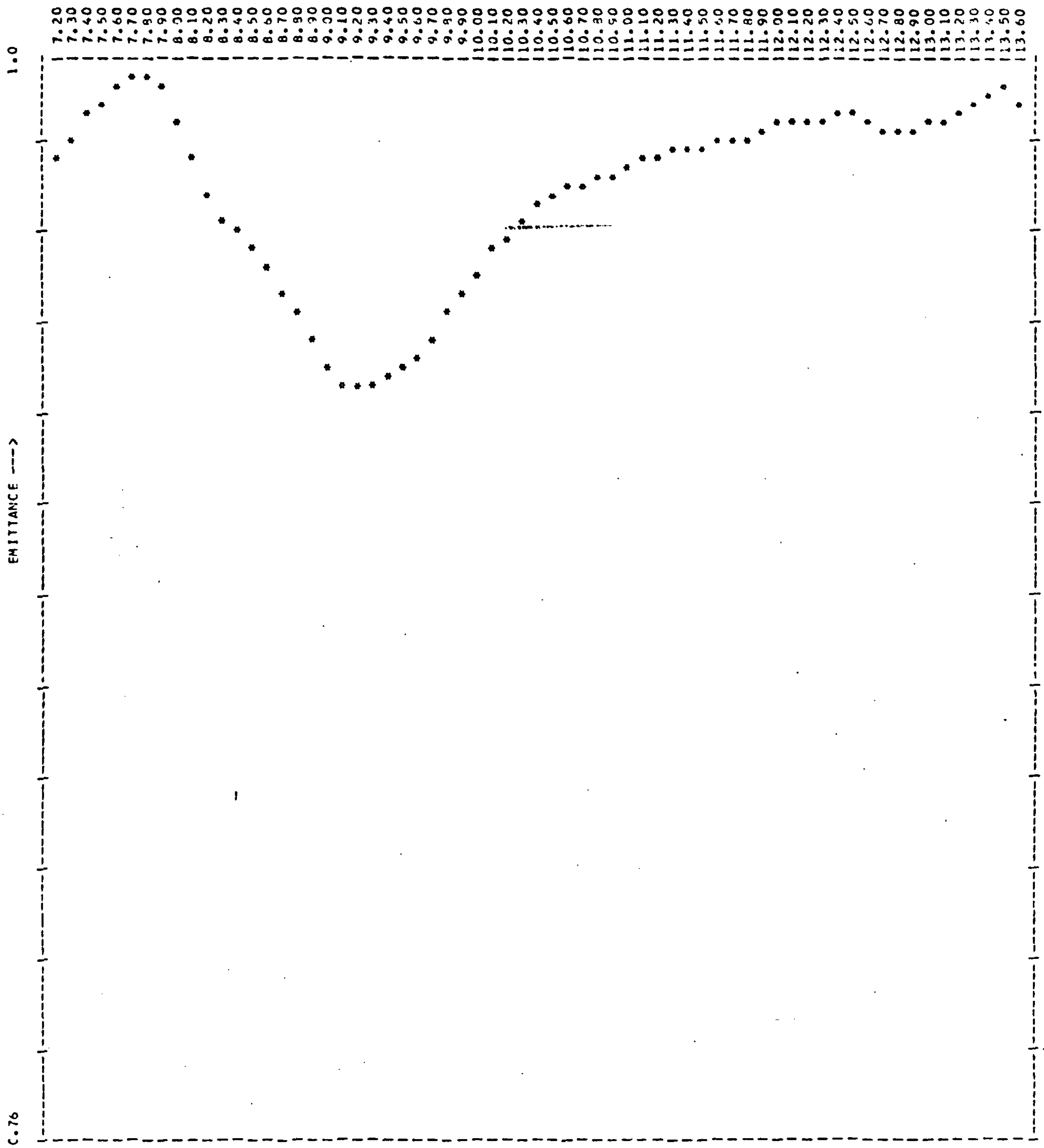
72 07 17 1P1C CROW SPRINGS C#51 PERLITE(SIO2.H2O) FRESH SURFACE
YC=-C.300 CALIB. DIST.=-6.18 VOLTS PER INCH= 0.0485 OHMS= 452.50
INTERNAL REF. TEMPERATURE= 33.95 TARGET TEMPERATURE= 34.0C
WAVELENGTH OF EMIT. MAX.= 7.66
TARGET TEMPERATURE (SPECTROMETER) = 32.94
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.987	7.300 [illegible]	7.400 0.995	7.500 0.999	7.600 1.00C	7.700 1.001	7.80C 1.000	7.900 0.994
8.000 0.985	8.100 0.976	8.200 0.966	8.300 0.962	8.400 0.959	8.500 0.955	8.600 0.953	8.700 0.950
8.800 0.944	8.900 0.937	9.000 0.926	9.100 0.914	9.200 0.910	9.300 0.907	9.400 0.908	9.500 0.912
9.600 0.914	9.700 0.920	9.800 0.928	9.900 0.934	10.000 0.940	10.100 0.945	10.200 C.950	10.300 0.955
10.400 0.959	10.500 0.962	10.600 0.964	10.700 0.965	10.800 0.967	10.900 0.968	11.000 C.970	11.100 0.971
11.200 0.972	11.300 0.973	11.400 0.974	11.500 0.975	11.600 0.977	11.700 0.978	11.800 C.979	11.900 0.979
12.000 0.980	12.100 0.980	12.200 0.981	12.300 0.982	12.400 0.983	12.500 0.983	12.600 0.982	12.700 0.982
12.800 0.981	12.900 0.980	13.000 0.979	13.100 0.980	13.200 0.983	13.300 0.988	13.400 0.991	13.500 0.992
13.600 0.993							



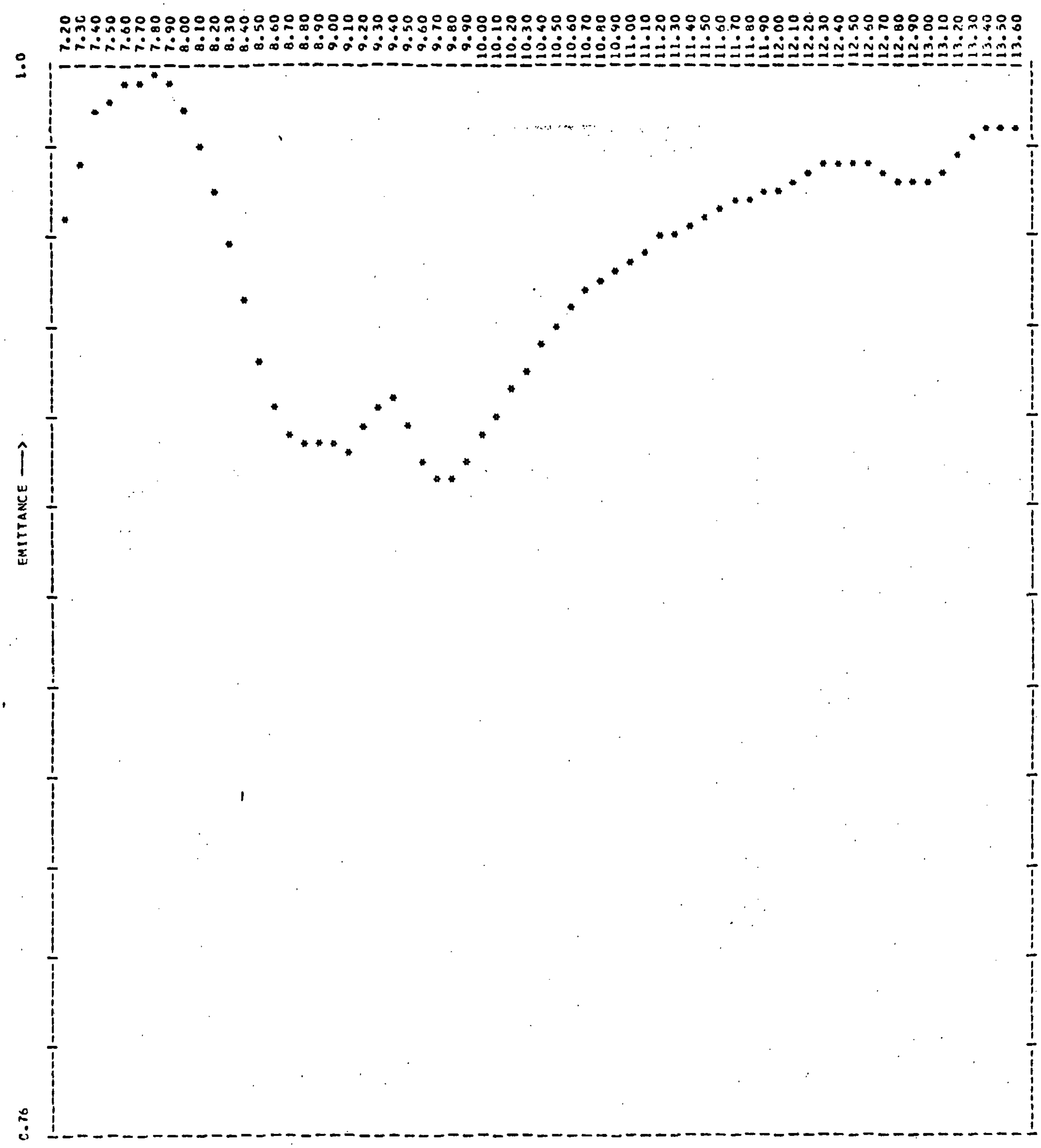
72 07 17   1815   CROW SPRINGS #051 PERLITE WITH OBSIDIAN INCULUSIONS FRESH SURFACE
YC=-0.300   CALIB. DIST.=-5.00   VOLTS PER INCH= 0.0600   OHMS= 452.20
INTERNAL REF. TEMPERATURE= 33.65   TARGET TEMPERATURE= 34.0C
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 32.45
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.974	7.300 0.984	7.400 0.991	7.500 0.994	7.600 0.998	7.700 0.999	7.800 0.998	7.900 0.991
8.000 0.979	8.100 0.967	8.200 0.956	8.300 0.951	8.400 0.949	8.500 0.947	8.600 0.943	8.700 0.937
8.800 0.929	8.900 0.919	9.000 0.905	9.100 0.890	9.200 0.883	9.300 0.879	9.400 0.880	9.500 0.881
9.600 0.886	9.700 0.894	9.800 0.905	9.900 0.915	10.000 0.925	10.100 0.933	10.200 0.939	10.300 0.944
10.400 0.950	10.500 0.955	10.600 0.958	10.700 0.960	10.800 0.962	10.900 0.964	11.000 0.965	11.100 0.967
11.200 0.969	11.300 0.970	11.400 0.972	11.500 0.973	11.600 0.975	11.700 0.976	11.800 0.978	11.900 0.979
12.000 0.980	12.100 0.981	12.200 0.981	12.300 0.983	12.400 0.983	12.500 0.983	12.600 0.982	12.700 0.981
12.800 0.980	12.900 0.979	13.000 0.980	13.100 0.983	13.200 0.987	13.300 0.990	13.400 0.990	13.500 0.993
13.600 [illegible]							



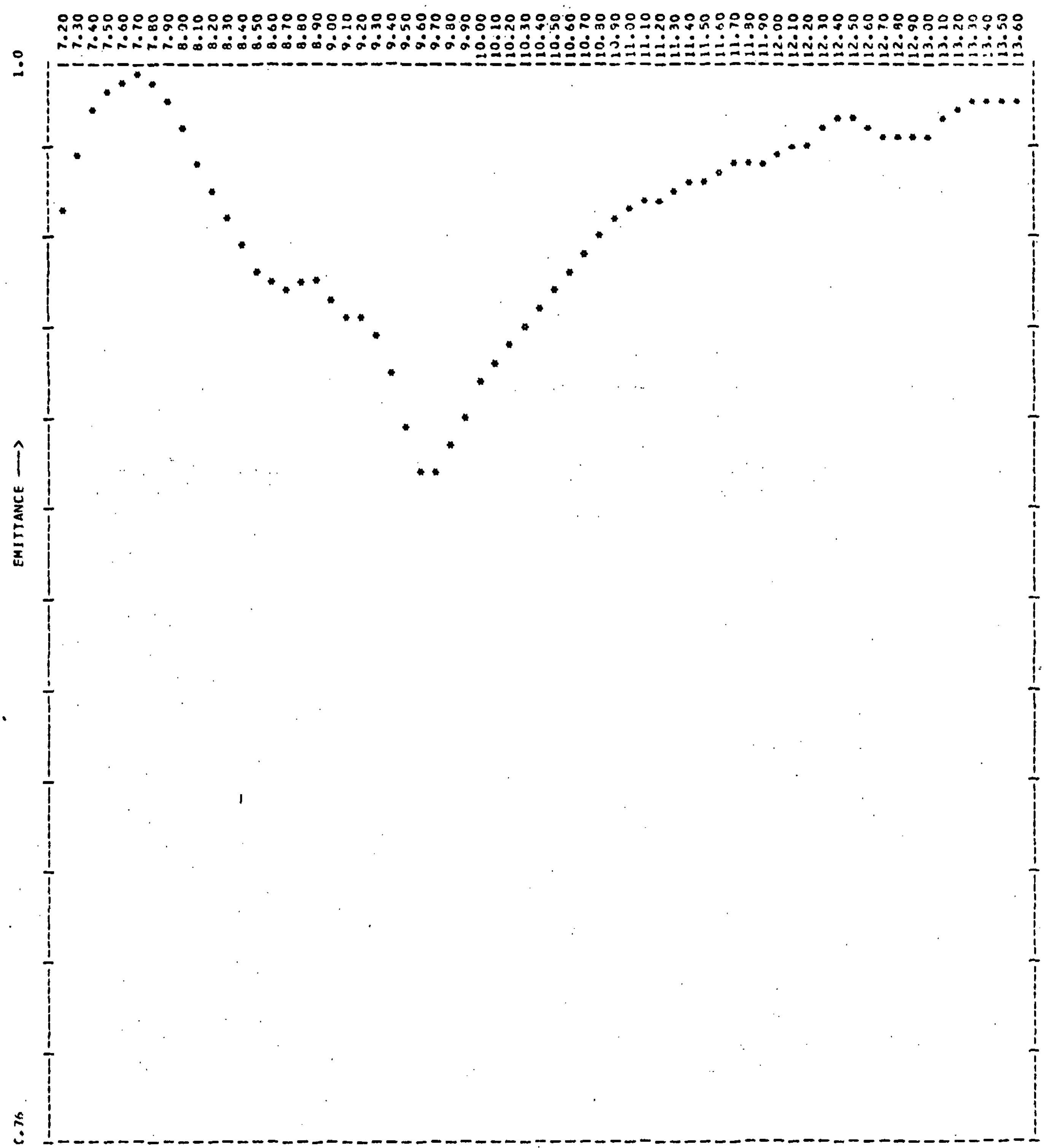
72 07 17 1820 CROW SPRINGS G#51 SPHERULITE IN PERLITE MATRIX ROUGH SURFACE
YC=-0.300 CALIB. DIST.=-5.00 VOLTS PER INCH= 0.0600 OHMS= 452.30
INTERNAL REF. TEMPERATURE= 33.72 TARGET TEMPERATURE= 33.50
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 32.11
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.978	7.300	0.983	7.400	0.989	7.500	0.992	7.600	0.995	7.700	0.997	7.800	0.997	7.900	0.994
8.000	0.987	8.100	0.979	8.200	0.972	8.300	0.966	8.400	0.962	8.500	0.958	8.600	0.954	8.700	0.949
8.800	0.944	8.900	0.939	9.000	0.934	9.100	0.929	9.200	0.928	9.300	0.929	9.400	0.932	9.500	0.934
9.600	0.936	9.700	0.939	9.800	0.944	9.900	0.949	10.000	0.954	10.100	0.958	10.200	0.962	10.300	0.965
10.400	0.968	10.500	0.971	10.600	0.972	10.700	0.973	10.800	0.974	10.900	0.976	11.000	0.977	11.100	0.978
11.200	0.980	11.300	0.980	11.400	0.981	11.500	0.982	11.600	0.982	11.700	0.983	11.800	0.984	11.900	0.985
12.000	0.986	12.100	0.987	12.200	0.987	12.300	0.988	12.400	0.989	12.500	0.989	12.600	0.988	12.700	0.986
12.800	0.985	12.900	0.986	13.000	0.987	13.100	0.988	13.200	0.989	13.300	0.991	13.400	0.993	13.500	0.994
13.600	0.991														



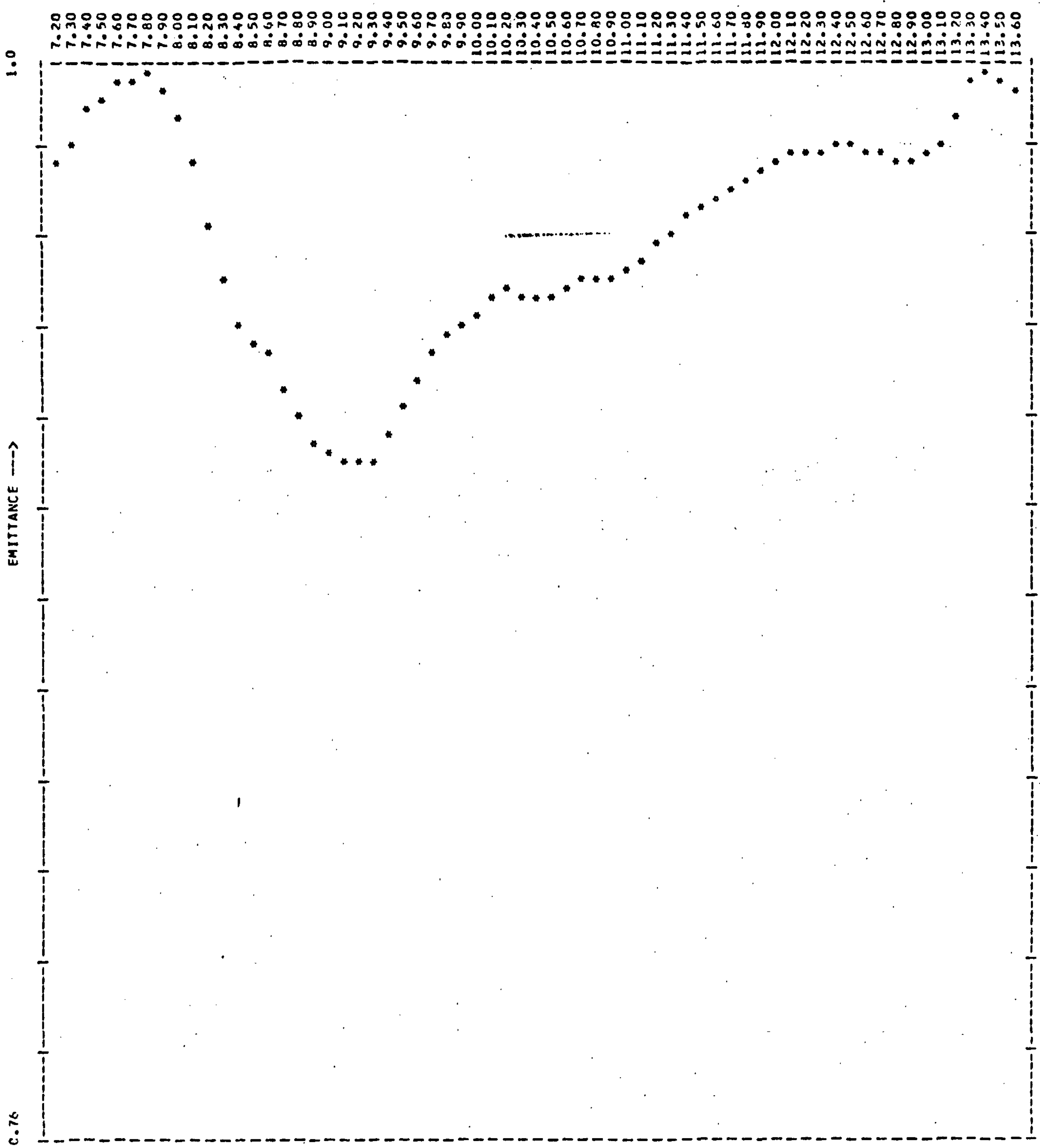
72 07 17 1525 CROW SPRINGS 2#72 STRONGLY WELDED LITHIC TUFF SAWED
YC=-0.309 CALIB. DIST.=-6.15 VOLTS PER INCH= 0.0488 OHMS= 452.29
INTERNAL REF. TEMPERATURE= 33.65 TARGET TEMPERATURE= 34.50
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 33.22
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.966	7.300 0.978	7.400 0.991	7.500 0.992	7.600 0.996	7.700 0.998	7.800 0.999	7.900 0.997
8.000 0.991	8.100 0.984	8.200 0.973	8.300 0.961	8.400 0.949	8.500 0.935	8.600 0.925	8.700 0.919
8.800 0.918	8.900 0.918	9.000 0.916	9.100 0.915	9.200 0.920	9.300 0.925	9.400 0.927	9.500 0.921
9.600 0.913	9.700 0.908	9.800 0.909	9.900 0.913	10.000 0.919	10.100 0.923	10.200 0.929	10.300 0.933
10.400 0.938	10.500 0.943	10.600 0.947	10.700 0.951	10.800 0.954	10.900 0.956	11.000 0.958	11.100 0.960
11.200 0.962	11.300 0.964	11.400 0.966	11.500 0.967	11.600 0.969	11.700 0.970	11.800 0.972	11.900 0.972
12.000 0.973	12.100 0.975	12.200 0.977	12.300 0.979	12.400 0.979	12.500 0.979	12.600 0.979	12.700 0.977
12.800 0.976	12.900 0.974	13.000 0.974	13.100 0.976	13.200 0.981	13.300 0.985	13.400 0.986	13.500 0.987
13.600 0.987							



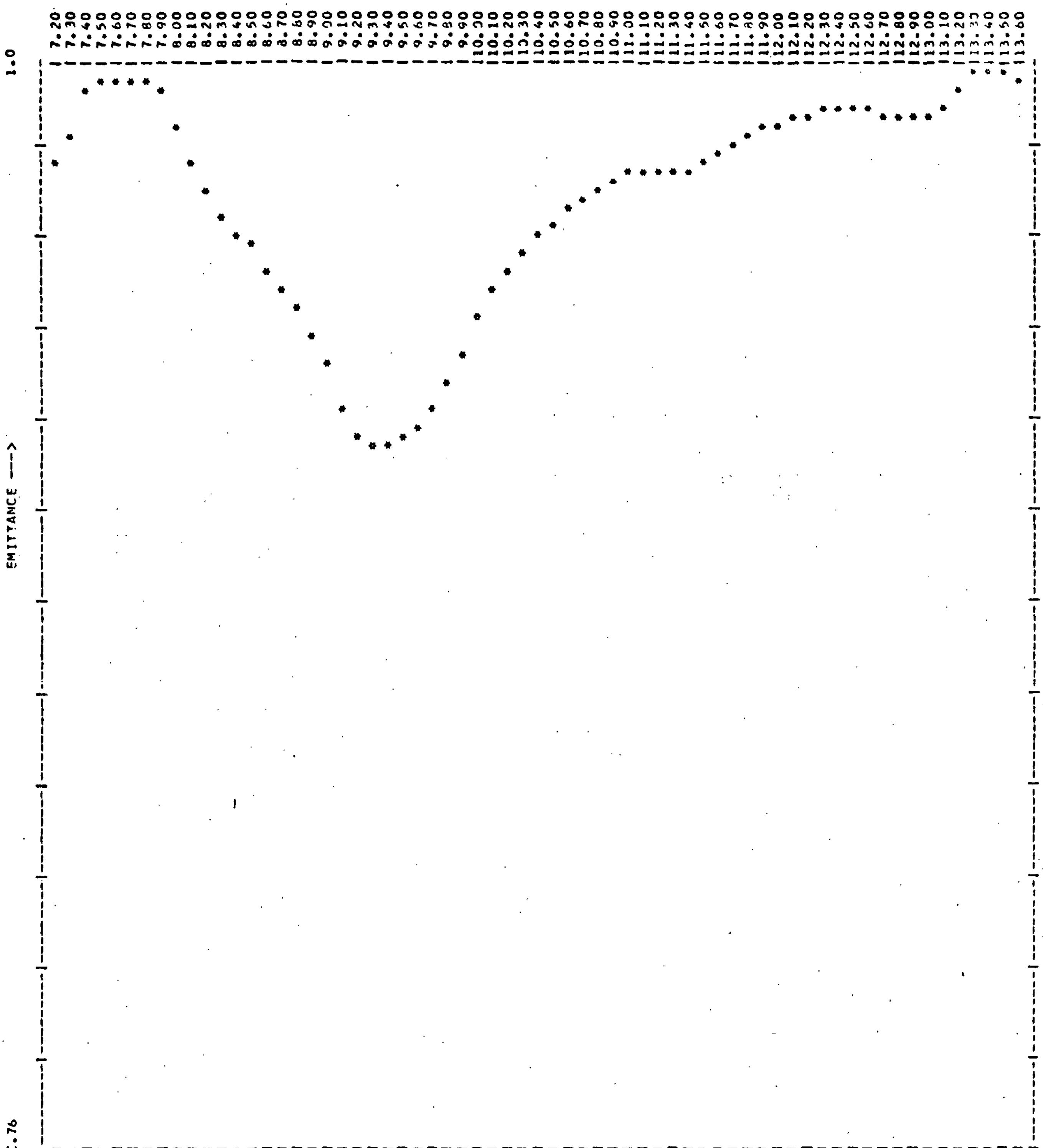
72 07 17 1835 CROW SPRINGS Q#72 STRONGLY WELDED LITHIC TUFF ROUGH
YC=-0.300 CALIB. DIST.=-6.16 VOLTS PER INCH= 0.0487 OHMS= 452.00
INTERNAL REF. TEMPERATURE= 33.52 TARGET TEMPERATURE= 34.50
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 32.84
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.969	7.300 0.982	7.400 0.992	7.500 0.994	7.600 0.997	7.700 0.999	7.800 0.997	7.900 0.994
8.000 0.987	8.100 0.979	8.200 0.972	8.300 0.967	8.400 0.961	8.500 0.955	8.600 0.953	8.700 0.952
8.800 0.953	8.900 0.953	9.000 0.949	9.100 0.945	9.200 0.946	9.300 0.941	9.400 0.933	9.500 0.921
9.600 0.911	9.700 0.910	9.800 0.917	9.900 0.923	10.000 0.931	10.100 0.936	10.200 0.940	10.300 0.944
10.400 0.947	10.500 0.951	10.600 0.955	10.700 0.959	10.800 0.963	10.900 0.967	11.000 0.969	11.100 0.971
11.200 0.972	11.300 0.973	11.400 0.974	11.500 0.976	11.600 0.977	11.700 0.978	11.800 0.979	11.900 0.979
12.000 0.981	12.100 0.982	12.200 0.984	12.300 0.986	12.400 0.988	12.500 0.988	12.600 0.987	12.700 0.985
12.800 0.985	12.900 0.985	13.000 0.986	13.100 0.988	13.200 0.991	13.300 0.994	13.400 0.993	13.500 0.993
13.600 0.994							



72 07 17 1845 SONORA PASS NAS44RS CALC SILICATE FRESH SURFACE
YC=-0.300 CALIB. DIST.=-5.00 VOLTS PER INCH= 0.0600 OHMS= 451.50
INTERNAL REF. TEMPERATURE= 33.20 TARGET TEMPERATURE= 33.0C
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 31.30
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.979	7.300 0.982	7.400 0.991	7.500 0.993	7.600 0.996	7.700 0.998	7.800 0.999	7.900 0.996
8.000 0.988	8.100 0.978	8.200 0.965	8.300 0.952	8.400 0.943	8.500 0.939	8.600 0.936	8.700 0.929
8.800 0.923	8.900 0.917	9.000 0.915	9.100 0.914	9.200 0.913	9.300 0.913	9.400 0.919	9.500 0.925
9.600 0.932	9.700 0.936	9.800 0.941	9.900 0.943	10.000 0.946	10.100 0.949	10.200 0.950	10.300 0.950
10.400 0.949	10.500 0.949	10.600 0.951	10.700 0.952	10.800 0.953	10.900 0.953	11.000 0.955	11.100 0.957
11.200 0.961	11.300 0.964	11.400 0.966	11.500 0.968	11.600 0.970	11.700 0.973	11.800 0.975	11.900 0.977
12.000 0.980	12.100 0.981	12.200 0.981	12.300 0.982	12.400 0.983	12.500 0.983	12.600 0.982	12.700 0.980
12.800 0.979	12.900 0.980	13.000 0.981	13.100 0.983	13.200 0.989	13.300 0.996	13.400 0.999	13.500 0.997
13.600 0.996							

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72 07 17   1850    CROW SPRINGS VITROPHERE -GLASS MATRIX(60%)   ROUGH SURFACE
YC=-0.300   CALIB. DIST.=-4.99   VOLTS PER INCH= 0.0601   OHMS= 451.20
INTERNAL REF. TEMPERATURE= 33.01   TARGET TEMPERATURE= 32.50
WAVELENGTH OF EMIT. MAX.= 13.28
TARGET TEMPERATURE (SPECTROMETER) =  30.83
EMITTANCES AT SPECIFIC WAVELENGTHS
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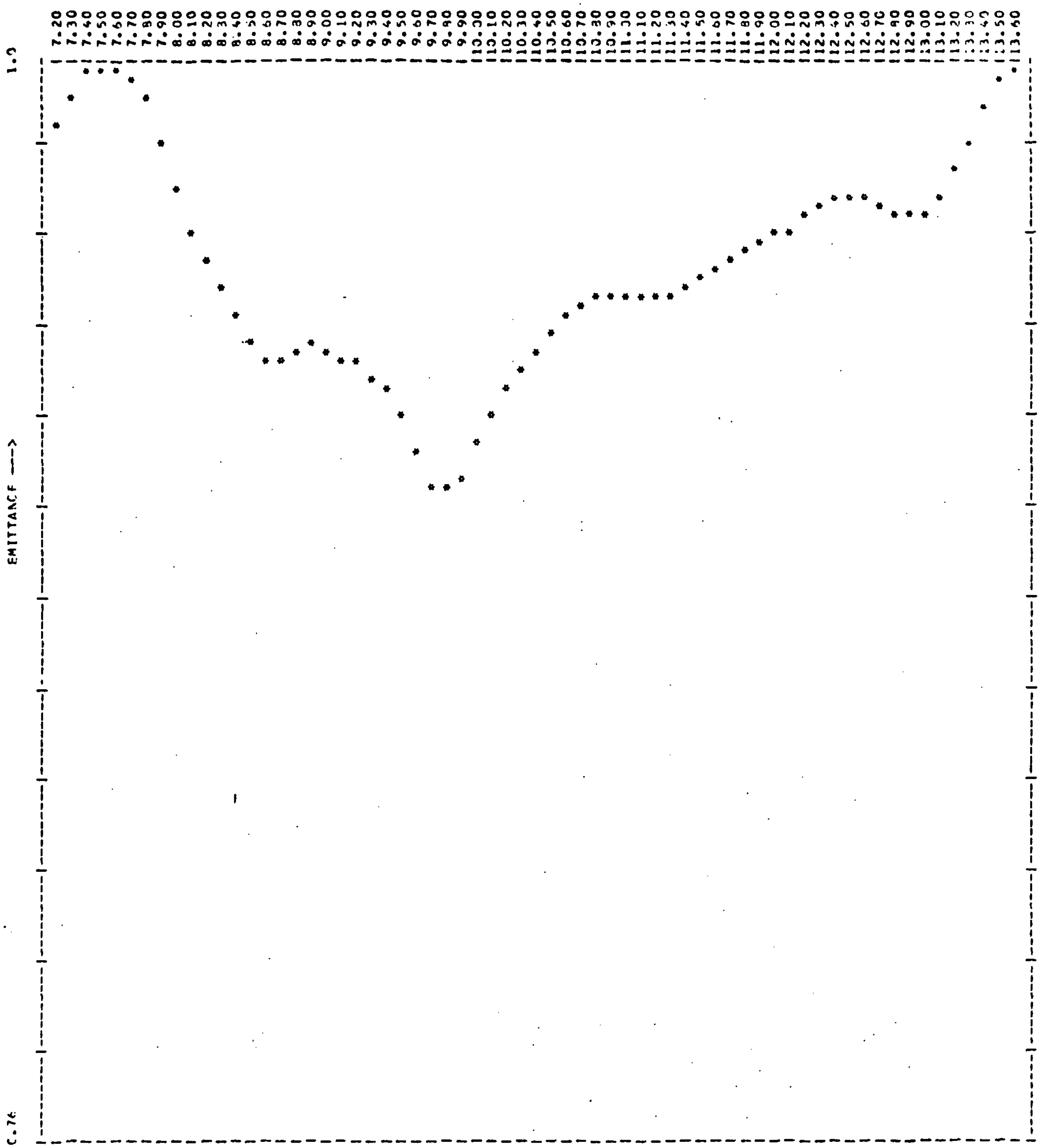
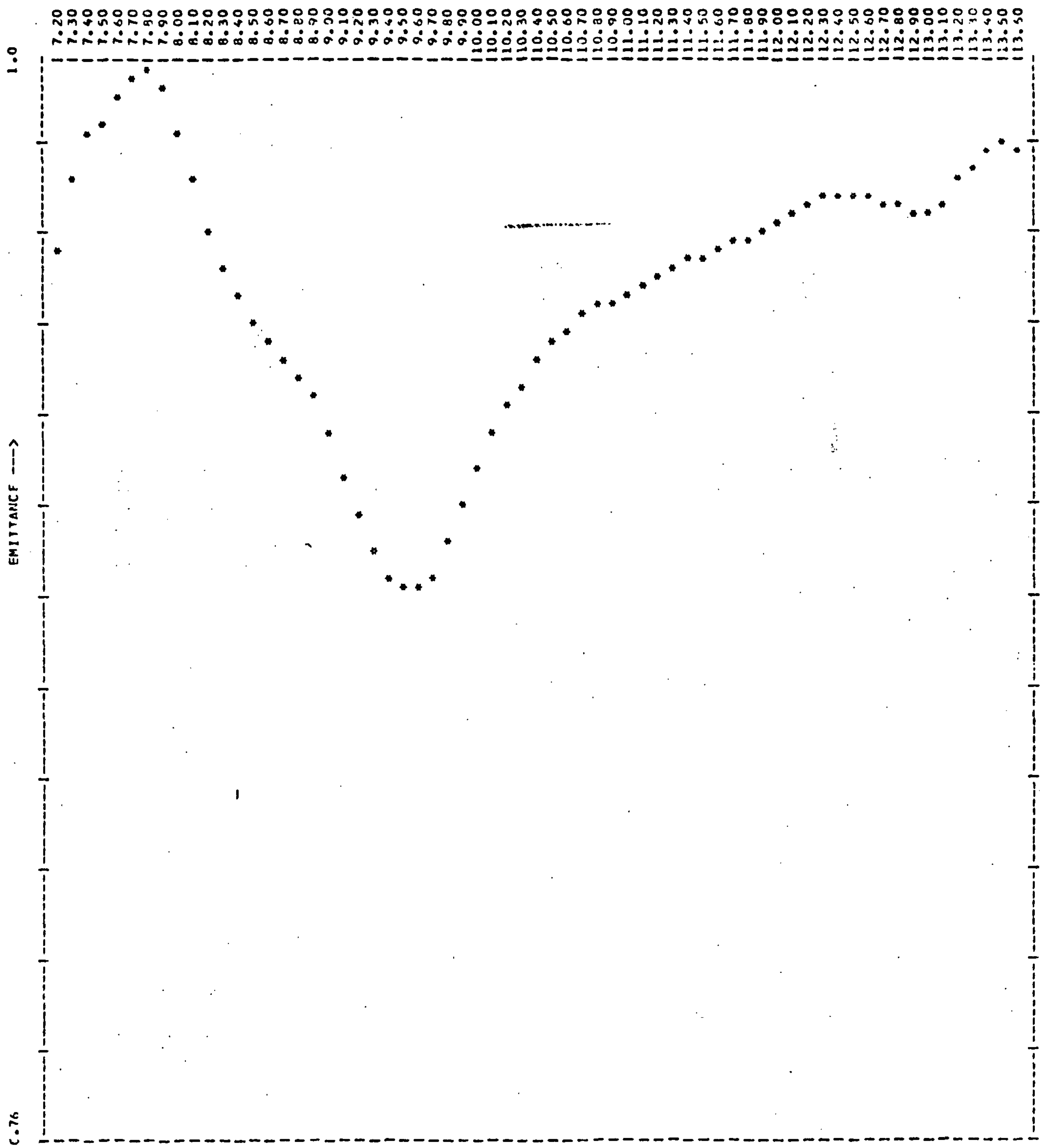
7.200 0.975	7.300 0.985	7.400 0.996	7.500 0.998	7.600 0.996	7.700 0.997	7.800 0.998	7.900 0.996
8.000 0.988	8.100 0.980	8.200 0.973	8.300 0.967	8.400 0.963	8.500 0.960	8.600 0.956	8.700 0.952
8.800 0.947	8.900 0.942	9.000 0.934	9.100 0.925	9.200 0.919	9.300 0.916	9.400 0.917	9.500 0.919
9.600 0.920	9.700 0.925	9.800 0.931	9.900 0.938	10.000 0.945	10.100 0.950	10.200 0.955	10.300 0.959
10.400 0.963	10.500 0.966	10.600 0.968	10.700 0.971	10.800 0.973	10.900 0.975	11.000 0.976	11.100 0.977
11.200 0.977	11.300 0.978	11.400 0.978	11.500 0.978	11.600 0.981	11.700 0.984	11.800 0.986	11.900 0.987
12.000 0.988	12.100 0.988	12.200 0.989	12.300 0.990	12.400 0.991	12.500 0.992	12.600 0.991	12.700 0.990
12.800 0.990	12.900 0.990	13.000 0.989	13.100 0.991	13.200 0.995	13.300 0.999	13.400 0.999	13.500 0.999
13.600 0.998							



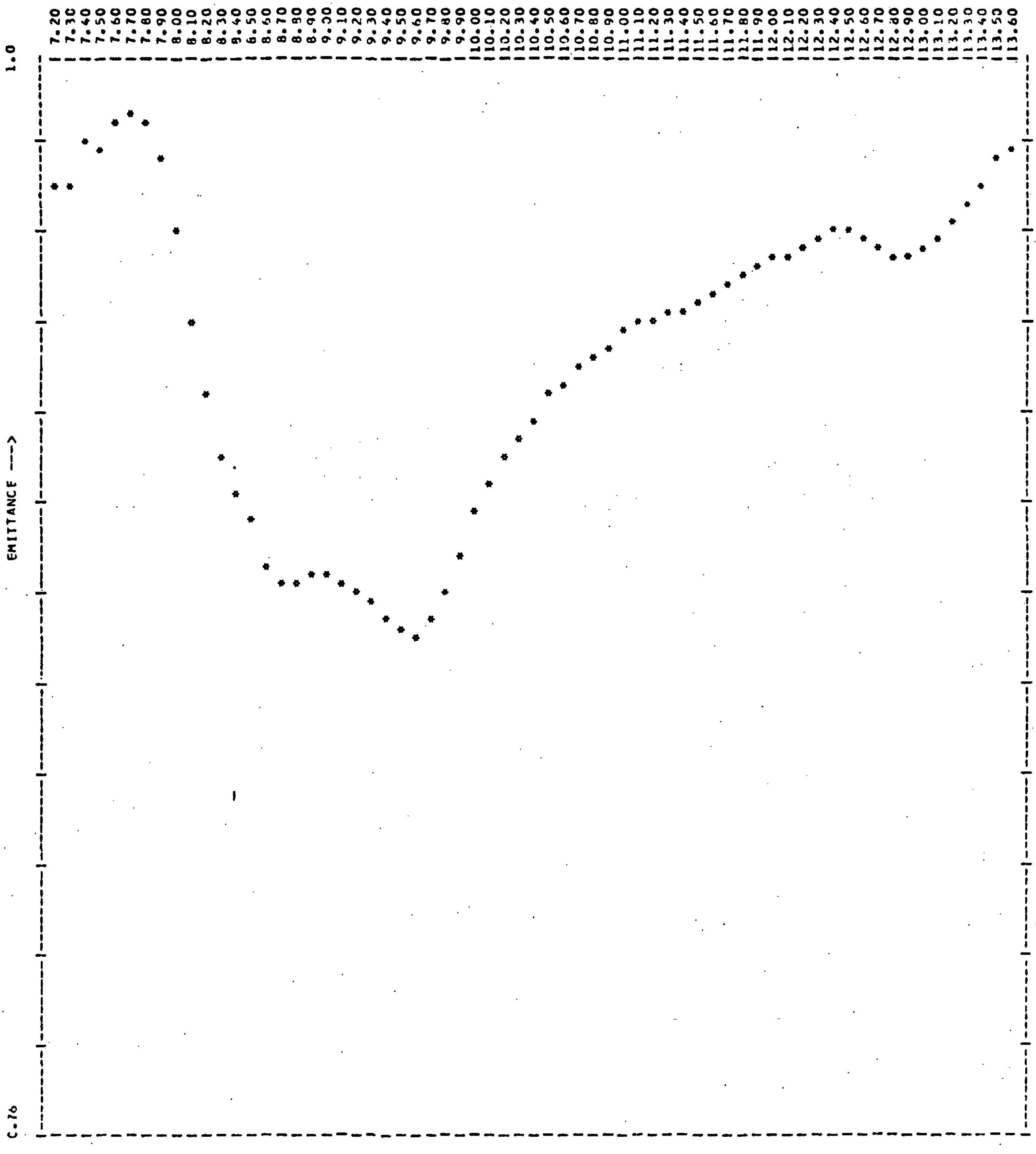
72 07 18 C935 CREA SPRINGS 0853 WELDED ASH FLOW TUFF WEATHERED WITH IRON STAIN
YC= 0.300 CALIB. DIST.= 6.13 VOLTS PER INCH= 0.0489 OHMS= 440.90
INTERNAL REF. TEMPERATURE= 26.36 TARGET TEMPERATURE= 30.50
WAVELENGTH OF EMIT. MAX.= 7.62
TARGET TEMPERATURE (SPECTROMETER) = 27.12
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.986	7.300 0.993	7.400 0.998	7.500 1.000	7.600 1.000	7.700 0.997	7.800 0.992	7.900 0.983
8.000 0.973	8.100 0.964	8.200 0.957	8.300 0.950	8.400 0.944	8.500 0.938	8.600 0.936	8.700 0.936
8.800 0.937	8.900 0.938	9.000 0.938	9.100 0.935	9.200 0.936	9.300 0.932	9.400 0.929	9.500 0.922
9.600 0.914	9.700 0.908	9.800 0.907	9.900 0.910	10.000 0.918	10.100 0.924	10.200 0.928	10.300 0.933
10.400 0.937	10.500 0.942	10.600 0.945	10.700 0.947	10.800 0.948	10.900 0.948	11.000 0.949	11.100 0.948
11.200 0.949	11.300 0.950	11.400 0.952	11.500 0.954	11.600 0.956	11.700 0.957	11.800 0.959	11.900 0.960
12.000 0.962	12.100 0.963	12.200 0.966	12.300 0.969	12.400 0.971	12.500 0.971	12.600 0.970	12.700 0.968
12.800 0.967	12.900 0.966	13.000 0.967	13.100 0.971	13.200 0.977	13.300 0.983	13.400 0.992	13.500 0.997
13.600 0.999							



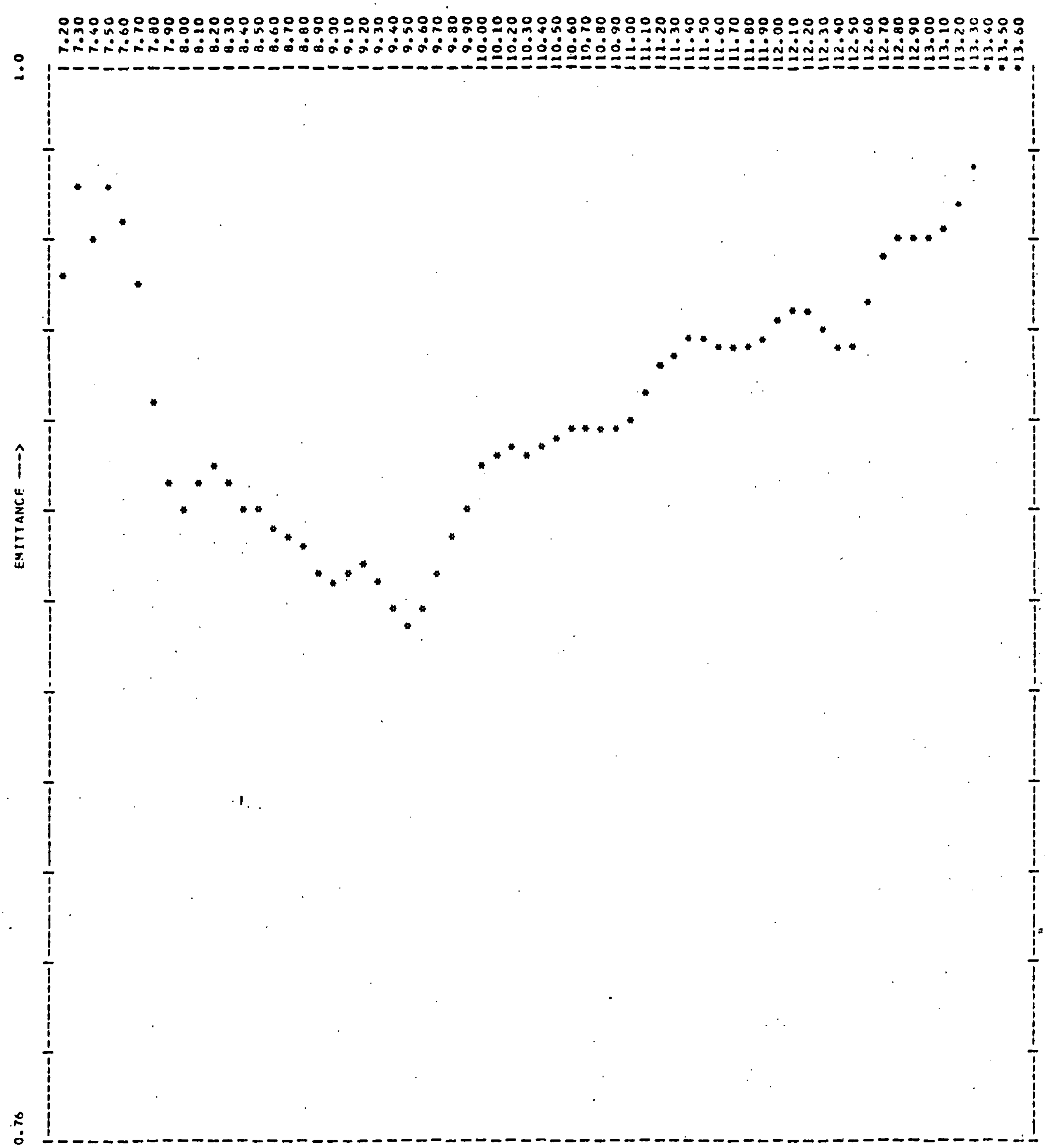
72 07 13 0940 CROW SPRINGS ON52 STRONGLY WELDED VITROPHERE ROUGH SURFACE
YC= 0.300 CALIB. DIST.= 6.13 VOLTS PER INCH= 0.0489 CEMS= 441.20
INTERNAL REF. TEMPERATURE= 26.56 TARGET TEMPERATURE= 32.50
WAVELENGTH OF EMIT. MAX.= 7.75
TARGET TEMPERATURE (SPECTROMETER) = 29.83
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.955	7.300 0.975	7.400 0.984	7.500 0.987	7.600 0.992	7.700 0.997	7.800 1.000	7.900 0.996
8.000 0.986	8.100 0.974	8.200 0.963	8.300 0.954	8.400 0.948	8.500 0.943	8.600 0.939	8.700 0.935
8.800 0.930	8.900 0.925	9.000 0.919	9.100 0.910	9.200 0.901	9.300 0.893	9.400 0.888	9.500 0.885
9.600 0.885	9.700 0.888	9.800 0.894	9.900 0.902	10.000 0.912	10.100 0.918	10.200 0.924	10.300 0.929
10.400 0.934	10.500 0.938	10.600 0.942	10.700 0.944	10.800 0.946	10.900 0.948	11.000 0.950	11.100 0.952
11.200 0.954	11.300 0.955	11.400 0.956	11.500 0.957	11.600 0.959	11.700 0.960	11.800 0.962	11.900 0.963
12.000 0.965	12.100 0.966	12.200 0.968	12.300 0.971	12.400 0.971	12.500 0.970	12.600 0.970	12.700 0.970
12.800 0.969	12.900 0.967	13.000 0.966	13.100 0.970	13.200 0.974	13.300 0.977	13.400 0.981	13.500 0.983
13.600 0.980							



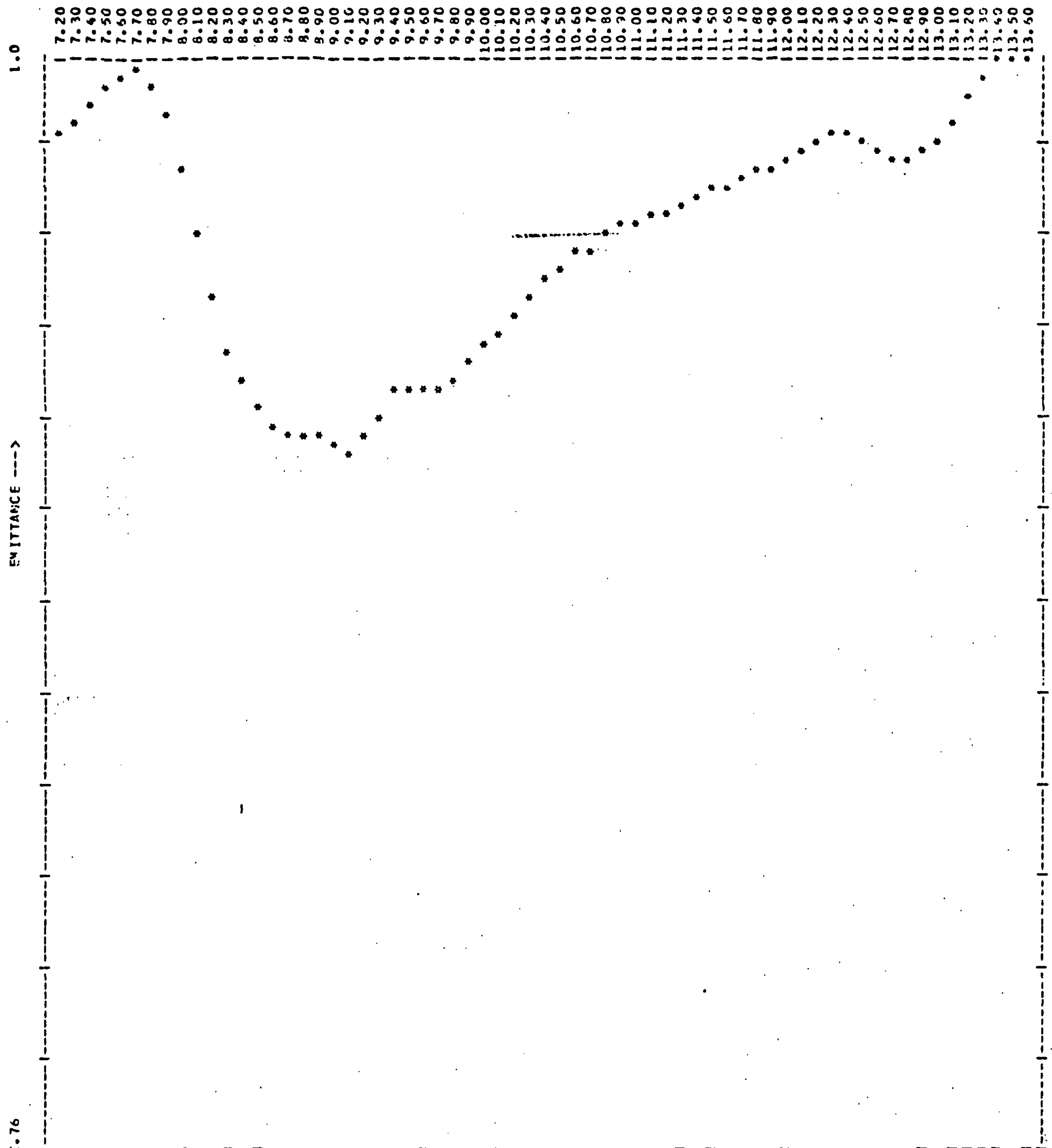
72 C7 1P 2945 CROW SPRINGS C455R CRYSTAL LITHIC QUARTZ LATITE ROUGH SURFACE
YC= 0.300 CALIB. DIST.= 4.22 VOLTS PER INCH= 0.0711 OHMS= 442.10
INTERNAL REF. TEMPERATURE= 27.14 TARGET TEMPERATURE= 35.10
WAVELENGTH OF EMIT. MAX.= 7.66
TARGET TEMPERATURE (SPECTROMETER) = 34.15
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.974	7.300 0.974	7.400 0.984	7.500 0.980	7.600 0.987	7.700 0.989	7.800 0.987	7.900 0.979
8.000 0.962	8.100 0.944	8.200 0.927	8.300 0.914	8.400 0.909	8.500 0.898	8.600 0.889	8.700 0.885
8.800 0.885	8.900 0.887	9.000 0.888	9.100 0.885	9.200 0.883	9.300 0.881	9.400 0.877	9.500 0.875
9.600 0.873	9.700 0.876	9.800 0.883	9.900 0.891	10.000 0.900	10.100 0.907	10.200 0.913	10.300 0.917
10.400 0.922	10.500 0.926	10.600 0.930	10.700 0.933	10.800 0.936	10.900 0.938	11.000 0.940	11.100 0.942
11.200 0.944	11.300 0.945	11.400 0.946	11.500 0.947	11.600 0.949	11.700 0.951	11.800 0.954	11.900 0.955
12.000 0.957	12.100 0.957	12.200 0.960	12.300 0.961	12.400 0.962	12.500 0.962	12.600 0.960	12.700 0.958
12.800 0.957	12.900 0.957	13.000 0.959	13.100 0.962	13.200 0.965	13.300 0.969	13.400 0.973	13.500 0.980
13.600 0.981							



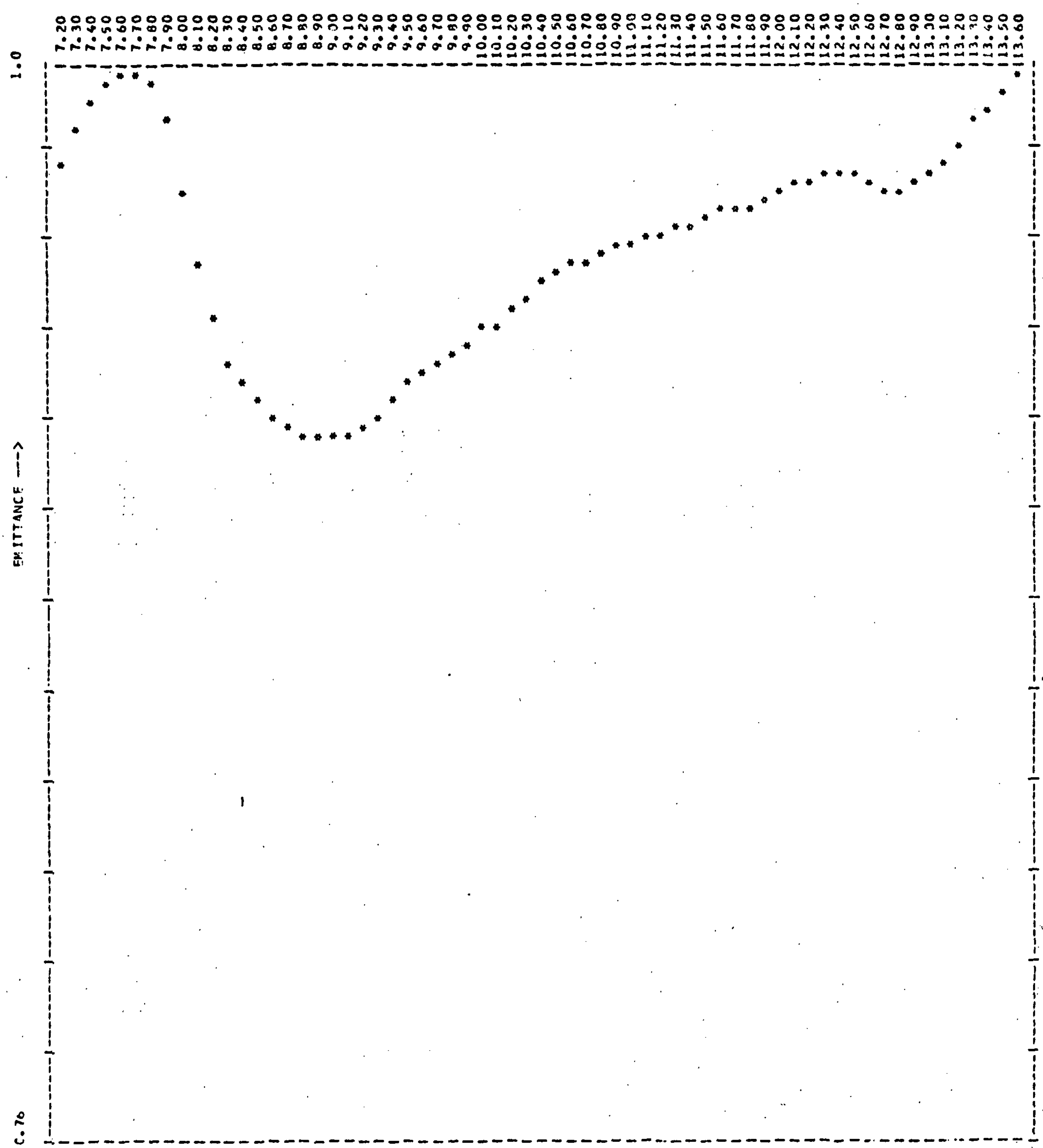
72 07 19 0953 CROW SPRINGS 0955P CRYSTAL LITHIC QUARTZ LATITE WEATHERD
YC= 0.300 CALIB. DIST.= 6.12 VOLTS PER INCH= 0.0490 OHMS= 443.50
INTERNAL REF. TEMPERATURE= 28.04 TARGET TEMPERATURE= 35.00
WAVELENGTH OF EMIT. MAX.= 13.60
TARGET TEMPERATURE (SPECTROMETER) = 31.38
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.955	7.300 0.976	7.400 0.963	7.500 0.975	7.600 0.966	7.700 0.953	7.800 0.927	7.900 0.910
8.000 0.904	8.100 0.910	8.200 0.913	8.300 0.908	8.400 0.903	8.500 0.903	8.600 0.900	8.700 0.898
8.800 0.895	8.900 0.889	9.000 0.887	9.100 0.890	9.200 0.890	9.300 0.887	9.400 0.881	9.500 0.876
9.600 0.881	9.700 0.887	9.800 0.897	9.900 0.904	10.000 0.912	10.100 0.916	10.200 0.916	10.300 0.916
10.400 0.916	10.500 0.919	10.600 0.922	10.700 0.922	10.800 0.921	10.900 0.920	11.000 0.923	11.100 0.930
11.200 0.935	11.300 0.938	11.400 0.940	11.500 0.940	11.600 0.939	11.700 0.938	11.800 0.940	11.900 0.941
12.000 0.945	12.100 0.947	12.200 0.947	12.300 0.945	12.400 0.935	12.500 0.938	12.600 0.950	12.700 0.960
12.800 0.966	12.900 0.963	13.000 0.963	13.100 0.965	13.200 0.972	13.300 0.979	13.400 1.003	13.500 1.028
13.600 1.042							



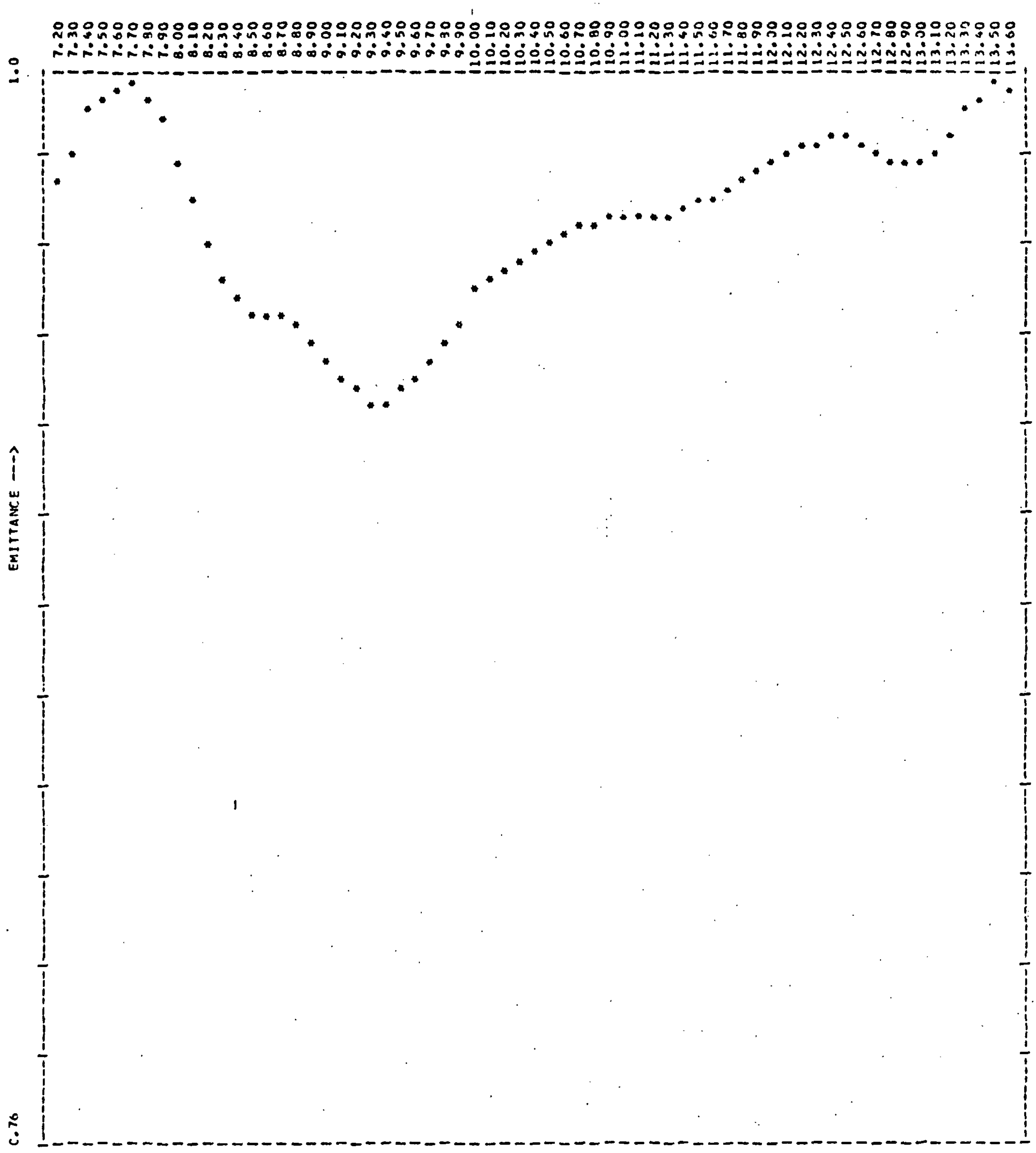
72 07 18 1005 CROW SPRINGS O#13 CRYSTAL LITHIC QUARTZ LATITE
YC=-0.300 CALIB. DIST.=-5.05 VOLTS PER INCH= 0.0594 OHMS= 444.00
INTERNAL REF. TEMPERATURE= 25.36 TARGET TEMPERATURE= 32.00
WAVELENGTH OF EMIT. MAX.= 13.39
TARGET TEMPERATURE (SPECTROMETER) = 26.81
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.985	7.300 0.987	7.400 0.991	7.500 0.995	7.600 0.998	7.700 0.998	7.800 0.995	7.900 0.989
8.000 0.977	8.100 0.962	8.200 0.949	8.300 0.938	8.400 0.931	8.500 0.925	8.600 0.920	8.700 0.918
8.800 0.918	8.900 0.918	9.000 0.917	9.100 0.915	9.200 0.919	9.300 0.923	9.400 0.929	9.500 0.930
9.600 0.929	9.700 0.929	9.800 0.932	9.900 0.934	10.000 0.939	10.100 0.942	10.200 0.945	10.300 0.949
10.400 0.953	10.500 0.956	10.600 0.958	10.700 0.960	10.800 0.962	10.900 0.964	11.000 0.965	11.100 0.967
11.200 0.968	11.300 0.970	11.400 0.971	11.500 0.972	11.600 0.973	11.700 0.975	11.800 0.976	11.900 0.978
12.000 0.979	12.100 0.981	12.200 0.983	12.300 0.985	12.400 0.985	12.500 0.984	12.600 0.982	12.700 0.980
12.800 0.979	12.900 0.981	13.000 0.983	13.100 0.987	13.200 0.992	13.300 0.997	13.400 1.000	13.500 1.004
13.600 1.007							



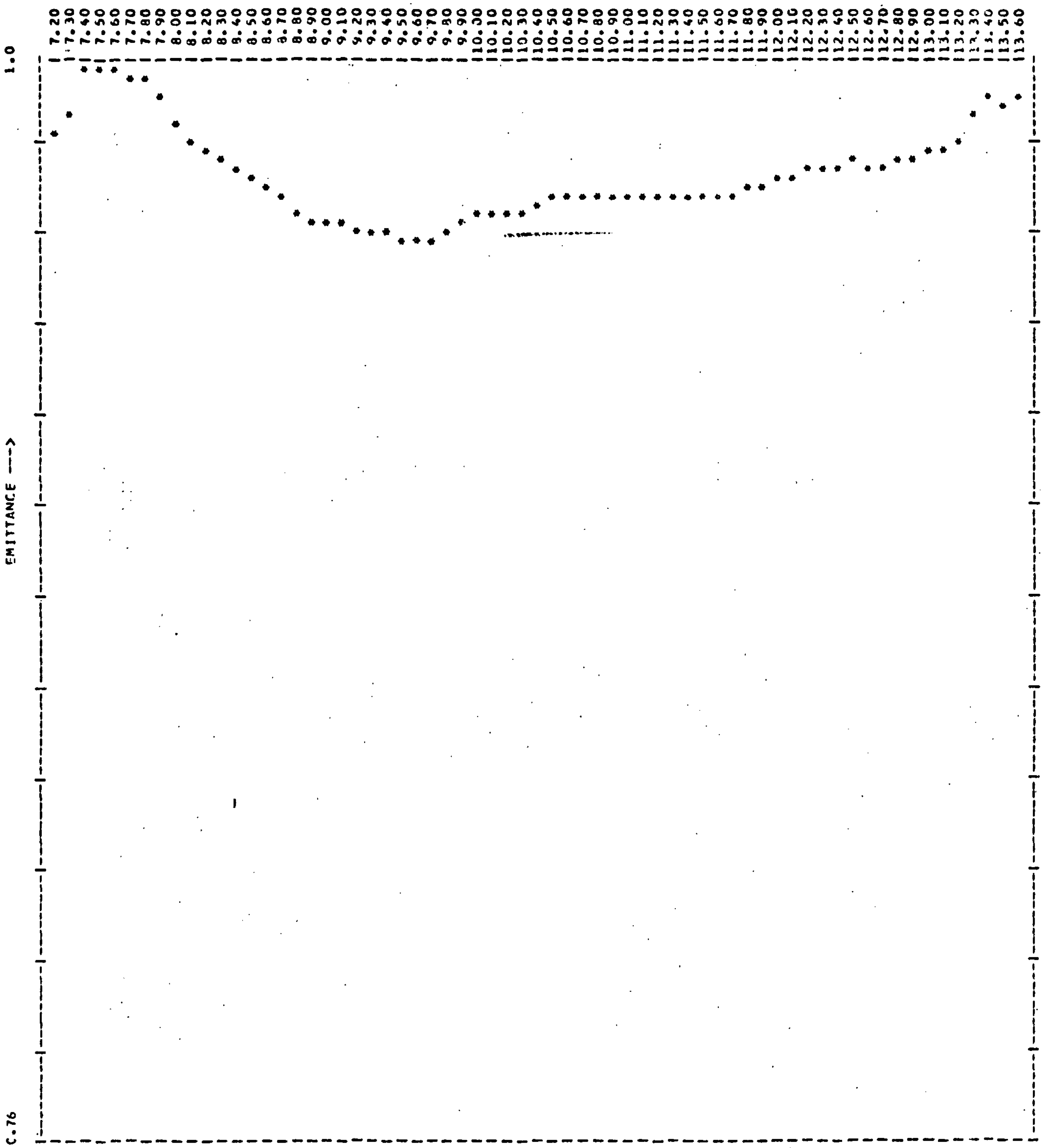
72 07 18   1010   CROW SPRINGS 0813   CRYSTAL LITHIC QUARTZ LATITE WEATHERD
YC=-0.300   CALIB. DIST.=-6.14   VOLTS PER INCH= 0.0489   EMMS= 445.00
INTERNAL REF. TEMPERATURE= 29.31   TARGET TEMPERATURE= 31.50
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 28.26
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.980	7.300 0.986	7.400 0.993	7.500 0.997	7.600 0.999	7.700 1.000	7.800 0.997	7.900 0.987
8.000 0.973	8.100 0.954	8.200 0.944	8.300 0.935	8.400 0.930	8.500 0.927	8.600 0.923	8.700 0.921
8.800 0.919	8.900 0.919	9.000 0.919	9.100 0.919	9.200 0.921	9.300 0.922	9.400 0.927	9.500 0.931
9.600 0.933	9.700 0.935	9.800 0.936	9.900 0.936	10.000 0.942	10.100 0.944	10.200 0.946	10.300 0.950
10.400 0.952	10.500 0.955	10.600 0.957	10.700 0.958	10.800 0.959	10.900 0.961	11.000 0.962	11.100 0.963
11.200 0.964	11.300 0.965	11.400 0.966	11.500 0.967	11.600 0.968	11.700 0.968	11.800 0.969	11.900 0.971
12.000 0.973	12.100 0.974	12.200 0.976	12.300 0.977	12.400 0.978	12.500 0.977	12.600 0.975	12.700 0.973
12.800 0.972	12.900 0.974	13.000 0.977	13.100 0.980	13.200 0.983	13.300 0.989	13.400 0.992	13.500 0.996
13.600 0.999							



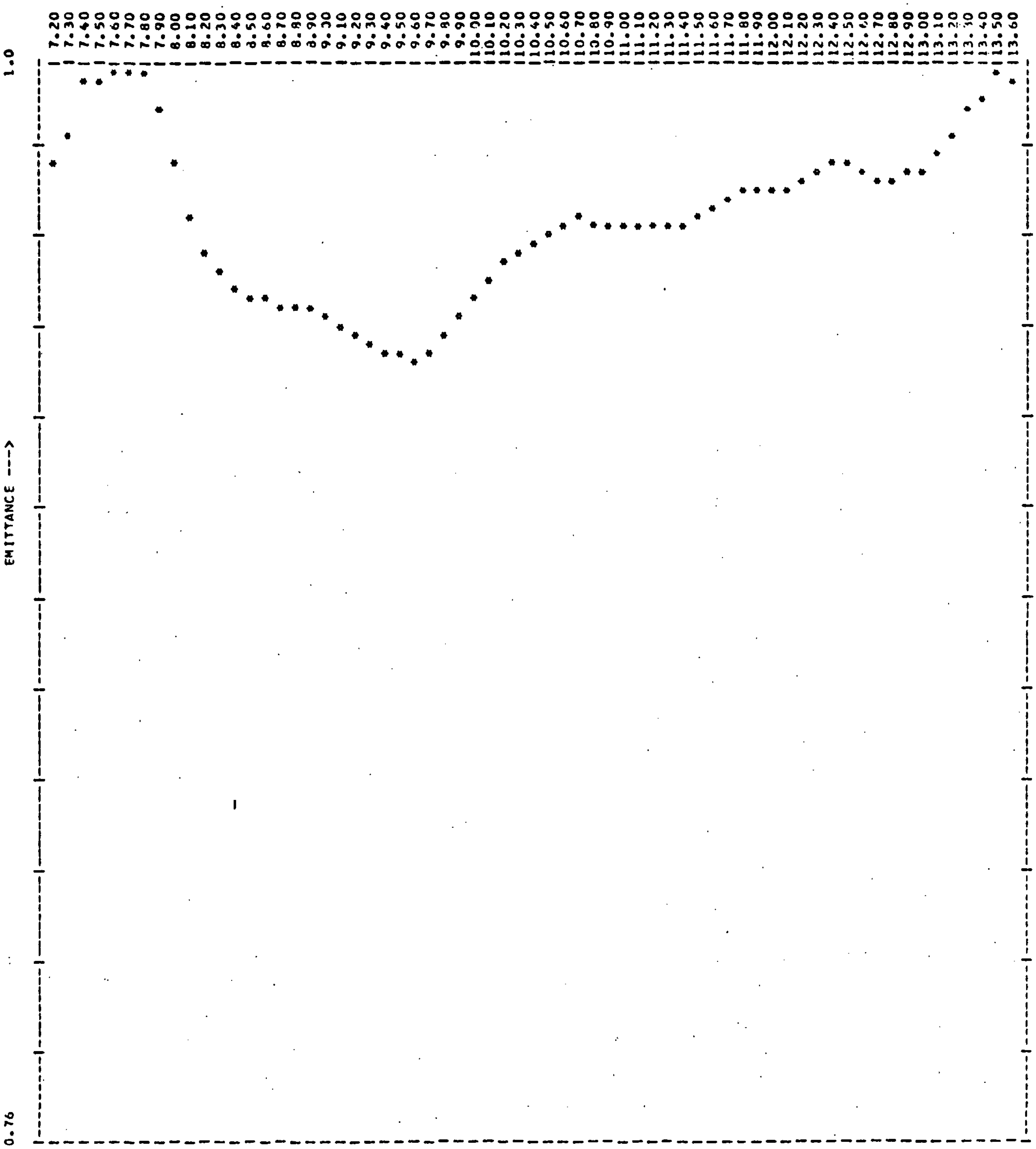
72 07 18 1020 CROW SPRINGS 0#55 STRONGLY WELDED QUARTZ BIOTITE LATITE
VC=-0.300 CALIB. DIST.=-6.17 VOLTS PER INCH= 0.0480 OHMS= 446.00
INTERNAL REF. TEMPERATURE= 29.45 TARGET TEMPERATURE= 31.00
WAVELENGTH OF EMIT. MAX.= 7.74
TARGET TEMPERATURE (SPECTROMETER) = 28.51
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.977	7.300	0.984	7.400	0.992	7.500	0.995	7.600	0.998	7.700	0.998	7.800	0.995	7.900	0.990
8.000	0.981	8.100	0.973	8.200	0.964	8.300	0.956	8.400	0.951	8.500	0.948	8.600	0.946	8.700	0.946
8.800	0.945	8.900	0.942	9.000	0.937	9.100	0.933	9.200	0.931	9.300	0.928	9.400	0.928	9.500	0.930
9.600	0.934	9.700	0.937	9.800	0.941	9.900	0.946	10.000	0.952	10.100	0.956	10.200	0.958	10.300	0.959
10.400	0.961	10.500	0.963	10.600	0.965	10.700	0.966	10.800	0.968	10.900	0.968	11.000	0.969	11.100	0.969
11.200	0.969	11.300	0.970	11.400	0.971	11.500	0.973	11.600	0.974	11.700	0.975	11.800	0.977	11.900	0.979
12.000	0.981	12.100	0.983	12.200	0.984	12.300	0.985	12.400	0.986	12.500	0.986	12.600	0.985	12.700	0.983
12.800	0.981	12.900	0.981	13.000	0.982	13.100	0.984	13.200	0.987	13.300	0.993	13.400	0.996	13.500	0.999
13.600	0.997														



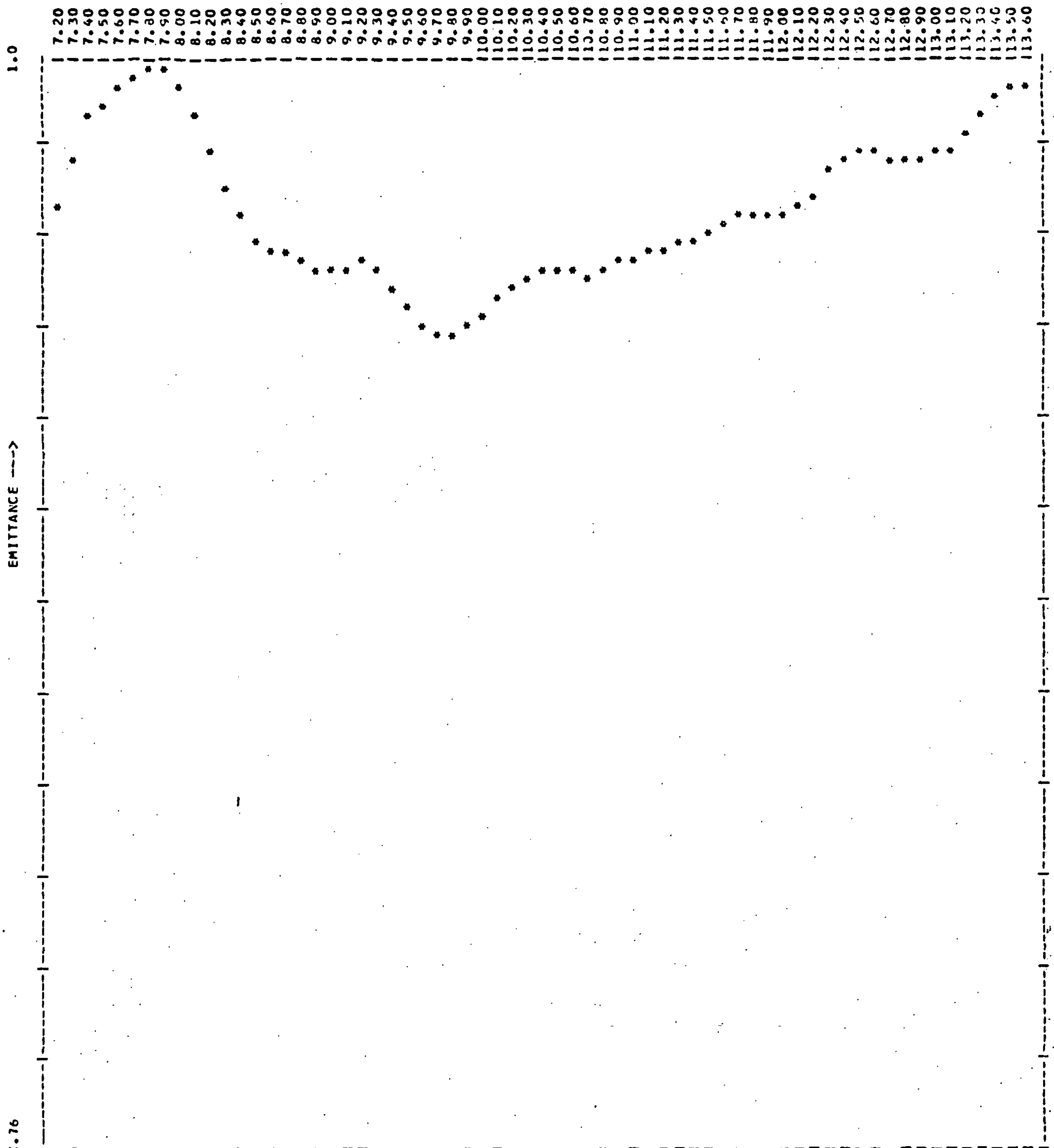
72 07 18 1025 CROW SPRINGS 3#74 UNWELDED PUMICE OR ASH
YC=-0.309 CALIB. DIST.=-6.16 VOLTS PER INCH= 0.0487 OHMS= 447.60
INTERNAL REF. TEMPERATURE= 30.59 TARGET TEMPERATURE= 30.00
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 27.32
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.986	7.300 0.988	7.400 0.999	7.500 1.000	7.600 1.000	7.700 0.997	7.800 0.997	7.900 0.993
8.000 0.987	8.100 0.983	8.200 0.980	8.300 0.978	8.400 0.976	8.500 0.974	8.600 0.973	8.700 0.971
8.800 0.968	8.900 0.966	9.000 0.965	9.100 0.964	9.200 0.963	9.300 0.963	9.400 0.964	9.500 0.962
9.600 0.961	9.700 0.961	9.800 0.963	9.900 0.965	10.000 0.967	10.100 0.967	10.200 0.968	10.300 0.968
10.400 0.969	10.500 0.971	10.600 0.972	10.700 0.971	10.800 0.971	10.900 0.971	11.000 0.971	11.100 0.972
11.200 0.971	11.300 0.971	11.400 0.971	11.500 0.971	11.600 0.971	11.700 0.972	11.800 0.973	11.900 0.974
12.000 0.975	12.100 0.975	12.200 0.976	12.300 0.977	12.400 0.978	12.500 0.978	12.600 0.978	12.700 0.979
12.800 0.979	12.900 0.980	13.000 0.980	13.100 0.981	13.200 0.983	13.300 0.988	13.400 0.993	13.500 0.992
13.600 0.993							



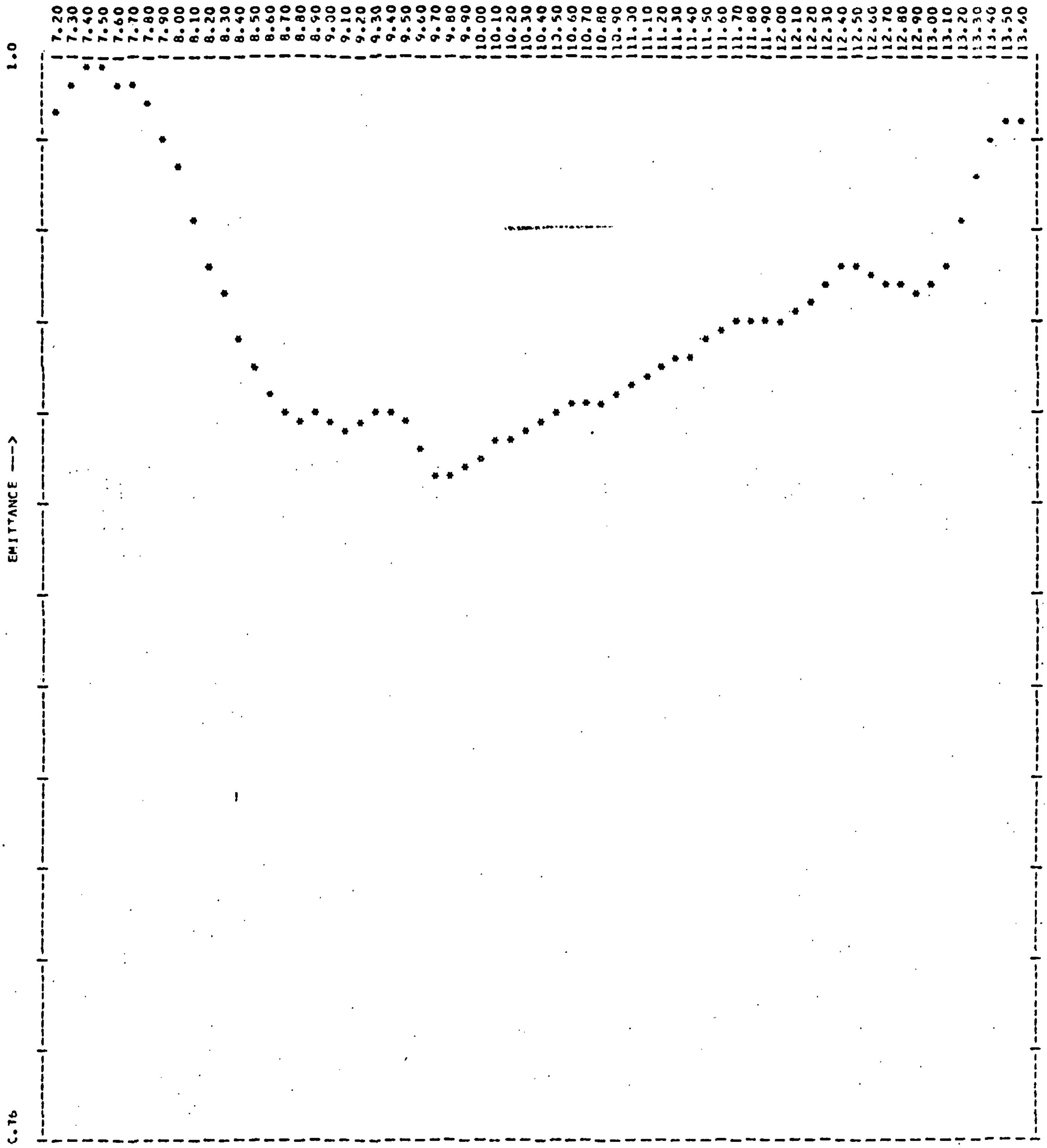
72 07 18 1035 CROW SPRINGS 0401 CRYSTAL LITHIC QUARTZ LATITE
YC=-0.300 CALIB. DIST.=-5.00 VOLTS PER INCH= 0.0600 OHMS= 448.50
INTERNAL REF. TEMPERATURE= 31.27 TARGET TEMPERATURE= 30.50
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 27.78
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.978	7.300 0.985	7.400 0.997	7.500 0.998	7.600 0.999	7.700 1.000	7.800 0.998	7.900 0.991
8.000 0.974	8.100 0.967	8.200 0.959	8.300 0.955	8.400 0.952	8.500 0.950	8.600 0.948	8.700 0.947
8.800 0.946	8.900 0.946	9.000 0.946	9.100 0.944	9.200 0.942	9.300 0.940	9.400 0.938	9.500 0.936
9.600 0.935	9.700 0.937	9.800 0.941	9.900 0.945	10.000 0.949	10.100 0.952	10.200 0.956	10.300 0.959
10.400 0.961	10.500 0.964	10.600 0.965	10.700 0.966	10.800 0.967	10.900 0.965	11.000 0.965	11.100 0.965
11.200 0.965	11.300 0.965	11.400 0.965	11.500 0.966	11.600 0.968	11.700 0.971	11.800 0.972	11.900 0.973
12.000 0.973	12.100 0.973	12.200 0.974	12.300 0.977	12.400 0.980	12.500 0.979	12.600 0.977	12.700 0.976
12.800 0.976	12.900 0.976	13.000 0.974	13.100 0.981	13.200 0.986	13.300 0.990	13.400 0.992	13.500 0.999
13.600 0.997							



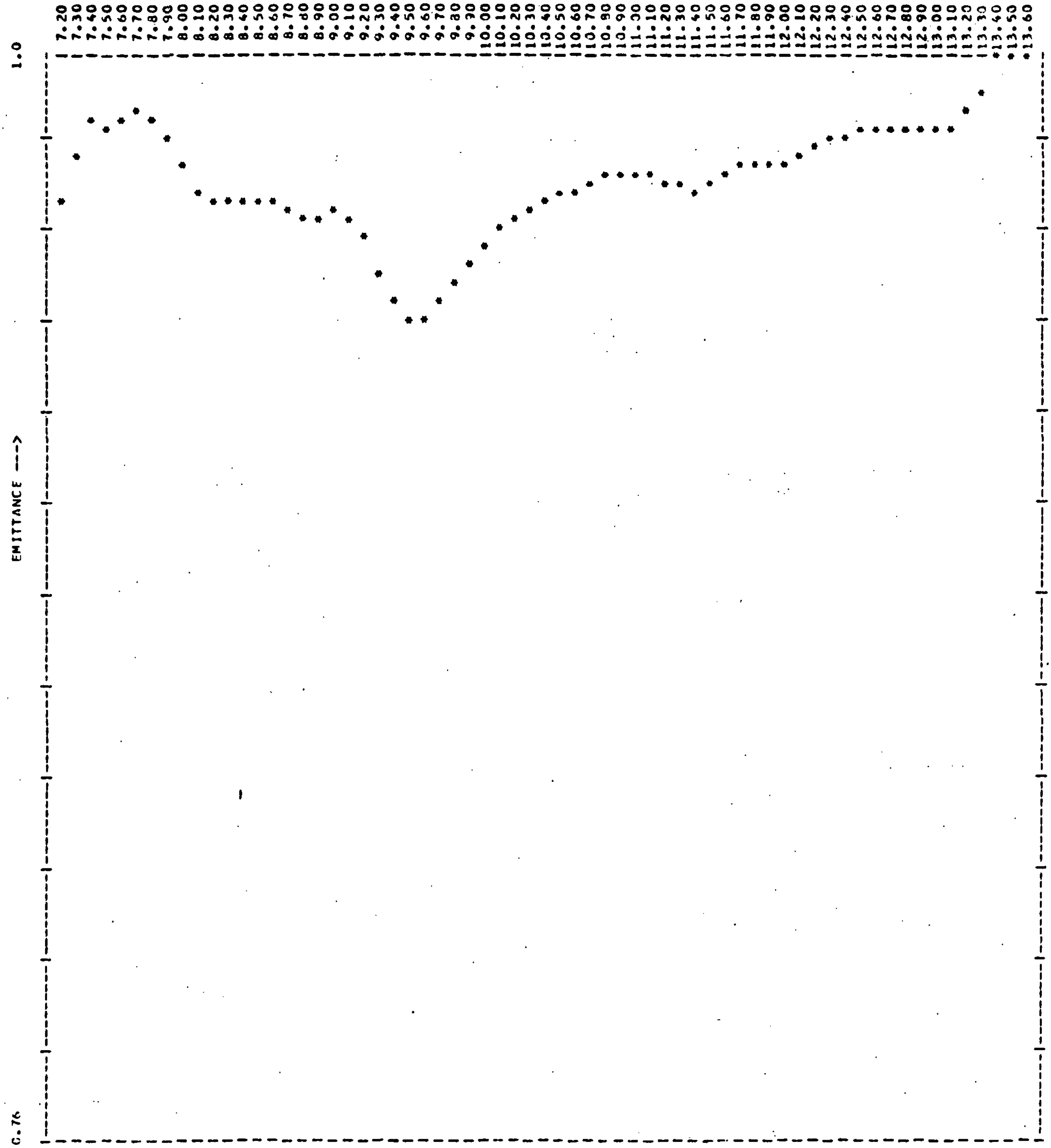
72 07 18 1040 BASALT/ANDESITE CROW SPRINGS O#17 VERY BASIC ROCK
YC=-0.300 CALIB. DIST.=-6.16 VOLTS PER INCH= 0.0487 OHMS= 440.00
INTERNAL REF. TEMPERATURE= 31.59 TARGET TEMPERATURE= 30.50
WAVELENGTH OF EMIT. MAX.= 7.73
TARGET TEMPERATURE (SPECTROMETER) = 29.11
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.970	7.300 0.978	7.400 0.989	7.500 0.991	7.600 0.994	7.700 0.997	7.800 0.999	7.900 0.995
8.000 0.995	8.100 0.990	8.200 0.982	8.300 0.973	8.400 0.967	8.500 0.962	8.600 0.960	8.700 0.958
8.800 0.956	8.900 0.955	9.000 0.955	9.100 0.955	9.200 0.956	9.300 0.955	9.400 0.952	9.500 0.947
9.600 0.944	9.700 0.941	9.800 0.942	9.900 0.943	10.000 0.945	10.100 0.948	10.200 0.951	10.300 0.954
10.400 0.955	10.500 0.955	10.600 0.954	10.700 0.954	10.800 0.955	10.900 0.956	11.000 0.957	11.100 0.958
11.200 0.959	11.300 0.960	11.400 0.961	11.500 0.963	11.600 0.965	11.700 0.966	11.800 0.967	11.900 0.967
12.000 0.968	12.100 0.969	12.200 0.972	12.300 0.976	12.400 0.980	12.500 0.981	12.600 0.980	12.700 0.979
12.800 0.978	12.900 0.981	13.000 0.980	13.100 0.982	13.200 0.985	13.300 0.989	13.400 0.994	13.500 0.996
13.600 0.996							



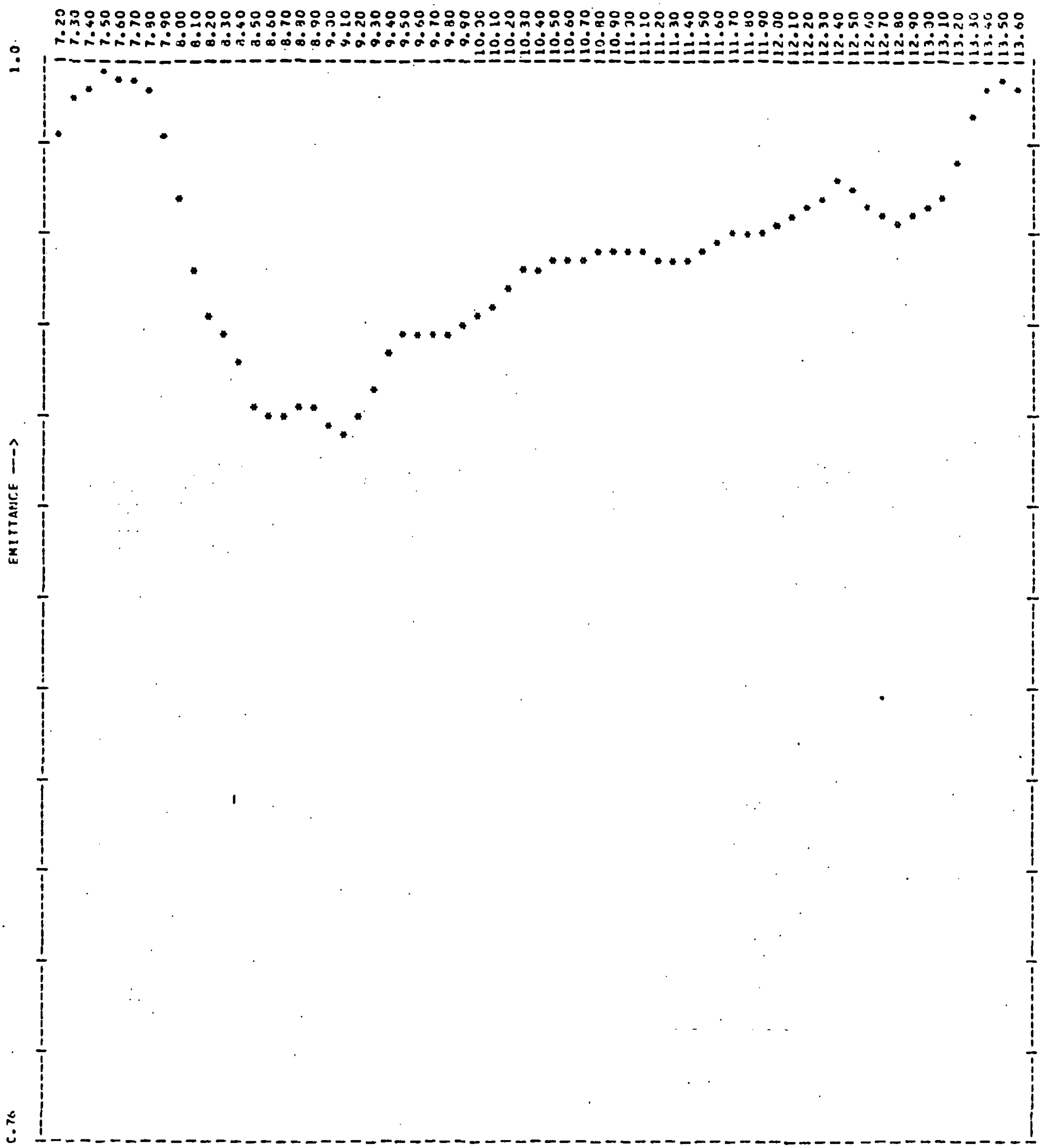
72 07 18 1050 CROW SPRINGS 0865 BASALTIC ANDESITE FRESH SURFACE
YC=-0.300 CALIB. DIST.=-4.08 VOLTS PER INCH= 0.0602 OHMS= 449.60
INTERNAL REF. TEMPERATURE= 31.58 TARGET TEMPERATURE= 31.00
WAVELENGTH OF EMIT. MAX.= 7.50
TARGET TEMPERATURE (SPECTROMETER) = 28.74
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.990	7.300	0.994	7.400	0.998	7.500	1.000	7.600	0.996	7.700	0.994	7.800	0.990	7.900	0.984
8.000	0.976	8.100	0.966	8.200	0.955	8.300	0.949	8.400	0.939	8.500	0.932	8.600	0.927	8.700	0.922
8.800	0.921	8.900	0.922	9.000	0.921	9.100	0.920	9.200	0.920	9.300	0.922	9.400	0.923	9.500	0.920
9.600	0.915	9.700	0.910	9.800	0.909	9.900	0.910	10.000	0.914	10.100	0.916	10.200	0.918	10.300	0.919
10.400	0.922	10.500	0.924	10.600	0.924	10.700	0.925	10.800	0.925	10.900	0.927	11.000	0.928	11.100	0.930
11.200	0.933	11.300	0.934	11.400	0.936	11.500	0.938	11.600	0.941	11.700	0.942	11.800	0.943	11.900	0.943
12.000	0.944	12.100	0.945	12.200	0.948	12.300	0.951	12.400	0.954	12.500	0.955	12.600	0.954	12.700	0.952
12.800	0.950	12.900	0.949	13.000	0.950	13.100	0.955	13.200	0.965	13.300	0.974	13.400	0.983	13.500	0.986
13.600	0.986														



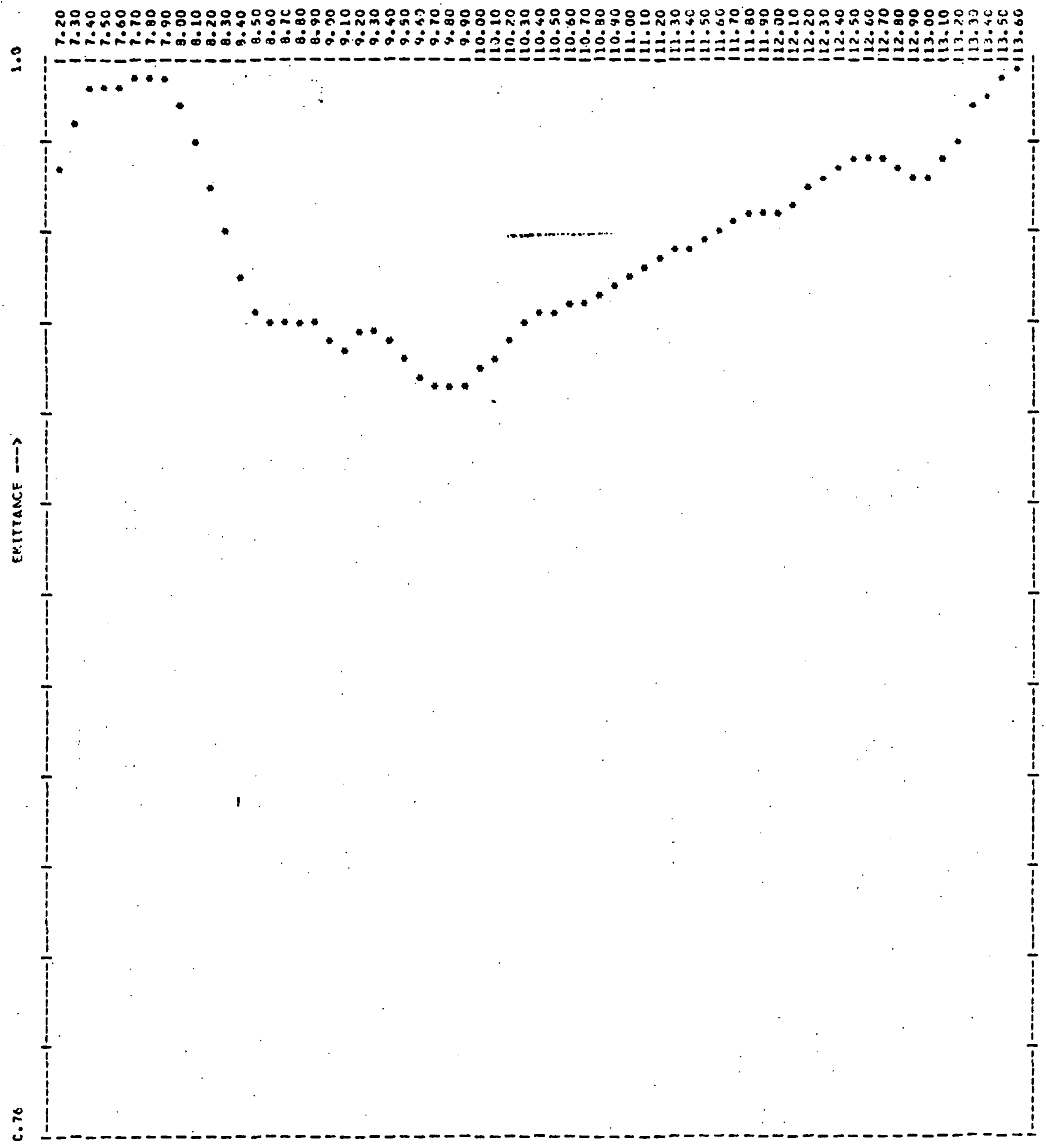
72 07 18 1055 CROW SPRINGS Q#115 STRONGLY WELDED DEVITRIFIED ASH FLOW TUFF
YC=-0.300 CALIB. DIST.=-6.15 VOLTS PER INCH= 0.0438 OHMS= 450.0C
INTERNAL REF. TEMPERATURE= 32.23 TARGET TEMPERATURE= 30.50
WAVELENGTH OF EMIT. MAX.= 13.50
TARGET TEMPERATURE (SPECTRC4ST=?) = 29.42
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.976	7.300 0.979	7.400 0.983	7.500 0.986	7.600 0.987	7.700 0.988	7.800 0.988	7.900 0.983
8.000 0.976	8.100 0.971	8.200 0.973	8.300 0.969	8.400 0.969	8.500 0.969	8.600 0.968	8.700 0.967
8.800 0.966	8.900 0.966	9.000 0.966	9.100 0.965	9.200 0.962	9.300 0.954	9.400 0.947	9.500 0.943
9.600 0.943	9.700 0.946	9.800 0.951	9.900 0.955	10.000 0.960	10.100 0.962	10.200 0.965	10.300 0.967
10.400 0.968	10.500 0.970	10.600 0.972	10.700 0.973	10.800 0.974	10.900 0.974	11.000 0.974	11.100 0.974
11.200 0.974	11.300 0.972	11.400 0.972	11.500 0.973	11.600 0.975	11.700 0.976	11.800 0.977	11.900 0.976
12.000 0.977	12.100 0.979	12.200 0.981	12.300 0.982	12.400 0.984	12.500 0.985	12.600 0.985	12.700 0.985
12.800 0.985	12.900 0.985	13.000 0.985	13.100 0.985	13.200 0.985	13.300 0.993	13.400 1.000	13.500 1.004
13.600 1.001							



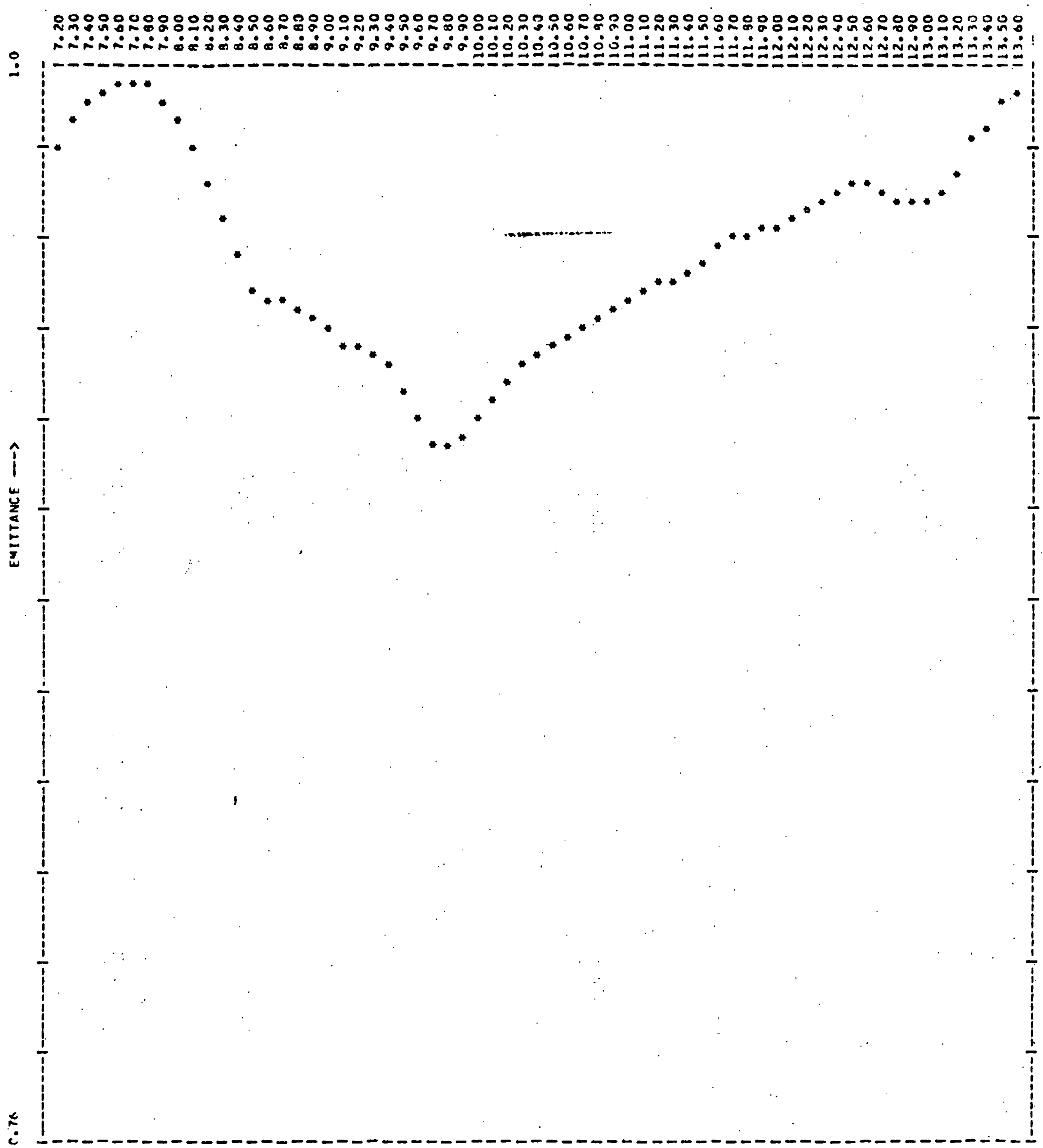
72 07 18 1105 CROW SPRINGS CA99 WELDED FINE GRAINED VITRIC TUFF WEATHERD
YC=-C.309 CALIB. DIST.=-4.29 VOLTS PER INCH= 0.0714 OHMS= 450.30
INTERNAL REF. TEMPERATURE= 32.43 TARGET TEMPERATURE= 30.50
WAVELENGTH OF EMIT. MAX.= 7.55
TARGET TEMPERATURE (SPECTROMETER) = 28.24
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.986	7.300 0.992	7.400 0.994	7.500 0.999	7.600 0.997	7.700 0.998	7.800 0.995	7.900 0.986
8.000 0.970	8.100 0.956	8.200 0.945	8.300 0.940	8.400 0.934	8.500 0.926	8.600 0.924	8.700 0.923
8.800 0.924	8.900 0.926	9.000 0.921	9.100 0.919	9.200 0.924	9.300 0.929	9.400 0.936	9.500 0.940
9.600 0.941	9.700 0.941	9.800 0.942	9.900 0.943	10.000 0.945	10.100 0.948	10.200 0.951	10.300 0.954
10.400 0.956	10.500 0.957	10.600 0.957	10.700 0.957	10.800 0.958	10.900 0.958	11.000 0.958	11.100 0.958
11.200 0.958	11.300 0.957	11.400 0.958	11.500 0.959	11.600 0.962	11.700 0.963	11.800 0.963	11.900 0.963
12.000 0.966	12.100 0.966	12.200 0.969	12.300 0.972	12.400 0.975	12.500 0.973	12.600 0.969	12.700 0.966
12.800 [illegible]	12.900 0.967	13.000 0.969	13.100 0.972	13.200 0.975	13.300 0.980	13.400 0.994	13.500 0.996
13.600 0.995							



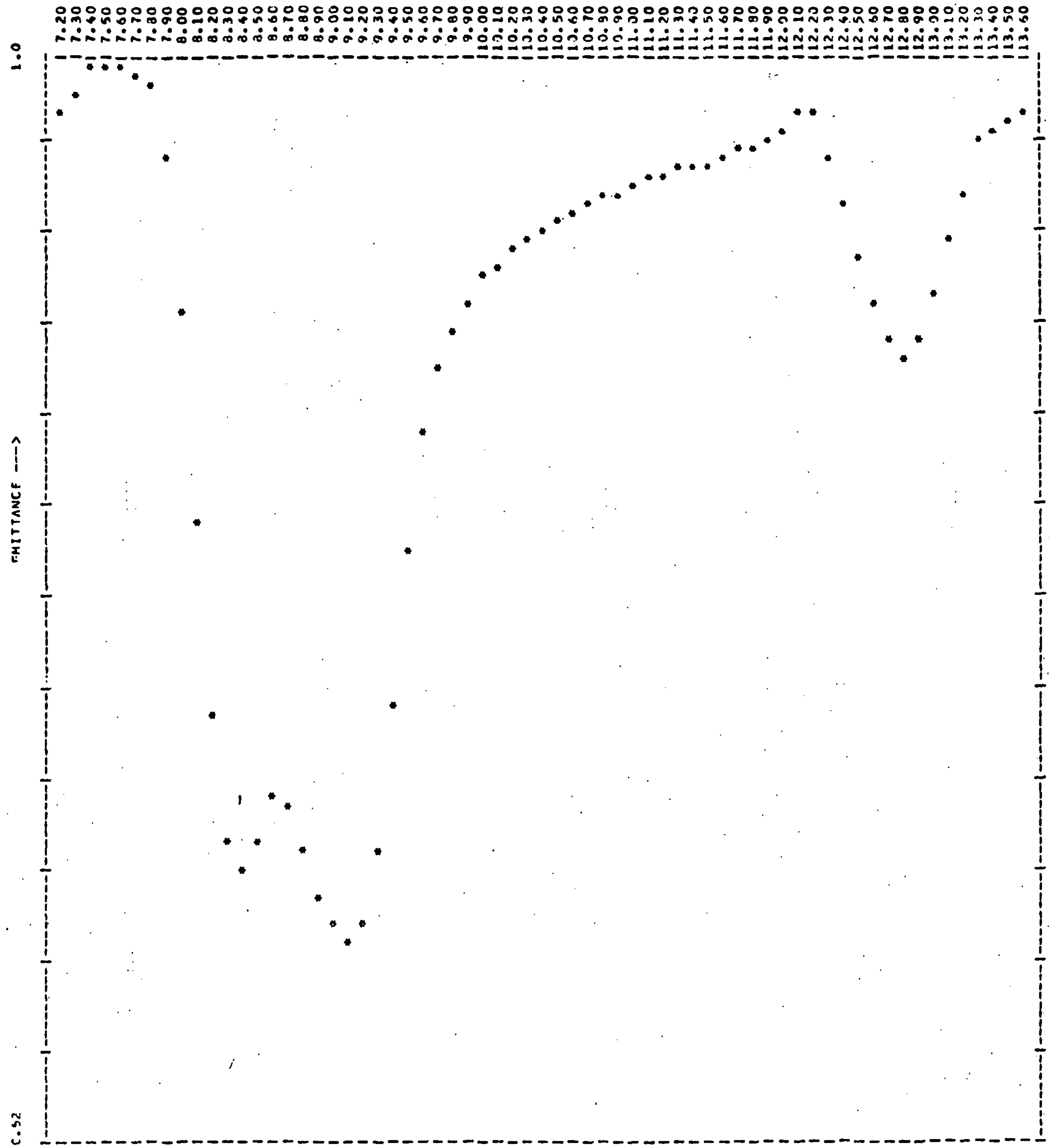
72 07 18   1119   CROW SPRINGS C#6B BASALTIC ANDESITE SAWED
YC=-0.300   CALIB. DIST.=-5.92   VOLTS PER INCH= 0.0598   OHMS= 450.30
INTERNAL REF. TEMPERATURE= 32.43   TARGET TEMPERATURE= 32.00
WAVELENGTH OF EMIT. MAX.= 7.87
TARGET TEMPERATURE (SPECTROMETER) = 29.65
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.977	7.300	0.987	7.400	0.995	7.500	0.996	7.600	0.995	7.700	0.996	7.800	0.998	7.900	0.996
8.000	0.991	8.100	0.984	8.200	0.973	8.300	0.963	8.400	0.953	8.500	0.945	8.600	0.944	8.700	0.944
8.800	0.943	8.900	0.942	9.000	0.940	9.100	0.938	9.200	0.941	9.300	0.941	9.400	0.939	9.500	0.936
9.600	0.932	9.700	0.925	9.800	0.929	9.900	0.930	10.000	0.932	10.100	0.935	10.200	0.940	10.300	0.943
10.400	0.945	10.500	0.945	10.600	0.946	10.700	0.946	10.800	0.948	10.900	0.950	11.000	0.953	11.100	0.955
11.200	0.957	11.300	0.958	11.400	0.960	11.500	0.961	11.600	0.963	11.700	0.965	11.800	0.967	11.900	0.968
12.000	0.969	12.100	0.971	12.200	0.972	12.300	0.975	12.400	0.977	12.500	0.979	12.600	0.979	12.700	0.978
12.800	0.977	12.900	0.976	13.000	0.976	13.100	0.978	13.200	0.983	13.300	0.991	13.400	0.993	13.500	0.997
13.600	0.998														



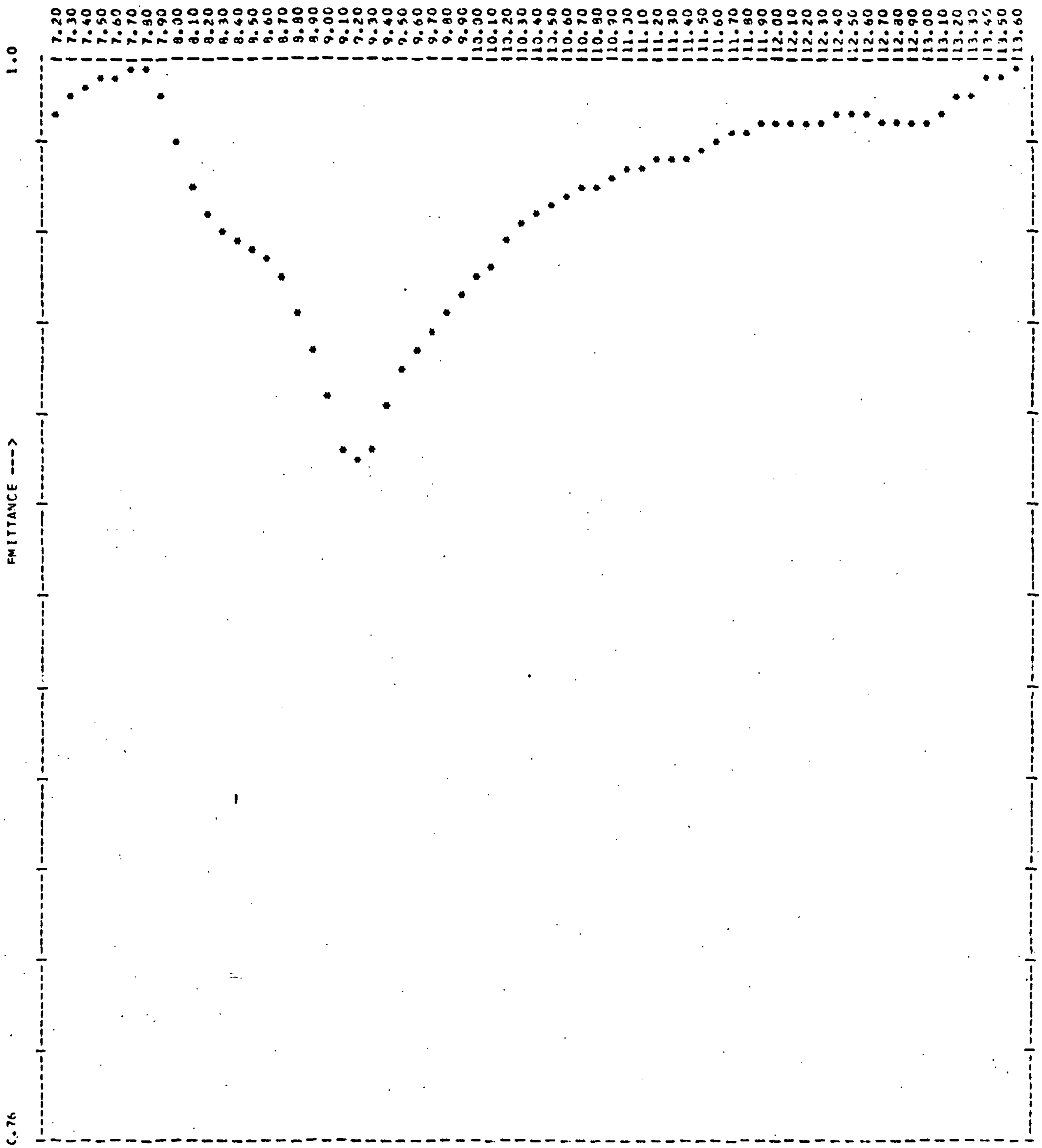
72 07 18   1135   CROW SPRINGS 0464 ANDESITE BASALT ROUGH SURFACE
YC=-0.300   CALIB. DIST.=-5.03   VOLTS PER INCH= 0.0596   OHMS= 451.00
INTERNAL REF. TEMPERATURE= 32.88   TARGET TEMPERATURE= 35.00
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 39.79
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.983	7.300 0.988	7.400 0.994	7.500 0.995	7.600 0.998	7.700 0.998	7.800 0.996	7.900 0.992
8.000 0.988	8.100 0.983	8.200 0.975	8.300 0.967	8.400 0.959	8.500 0.951	8.600 0.949	8.700 0.948
8.800 0.947	8.900 0.945	9.000 0.942	9.100 0.939	9.200 0.940	9.300 0.937	9.400 0.935	9.500 0.929
9.600 0.922	9.700 0.917	9.800 0.917	9.900 0.919	10.000 0.924	10.100 0.927	10.200 0.931	10.300 0.934
10.400 0.938	10.500 0.940	10.600 0.942	10.700 0.943	10.800 0.945	10.900 0.947	11.000 0.948	11.100 0.950
11.200 0.952	11.300 0.954	11.400 0.955	11.500 0.957	11.600 0.960	11.700 0.962	11.800 0.964	11.900 0.964
12.000 0.966	12.100 0.967	12.200 0.969	12.300 0.971	12.400 0.974	12.500 0.975	12.600 0.974	12.700 0.972
12.800 0.971	12.900 0.971	13.000 0.971	13.100 0.974	13.200 0.978	13.300 0.985	13.400 0.987	13.500 0.994
13.600 0.996							



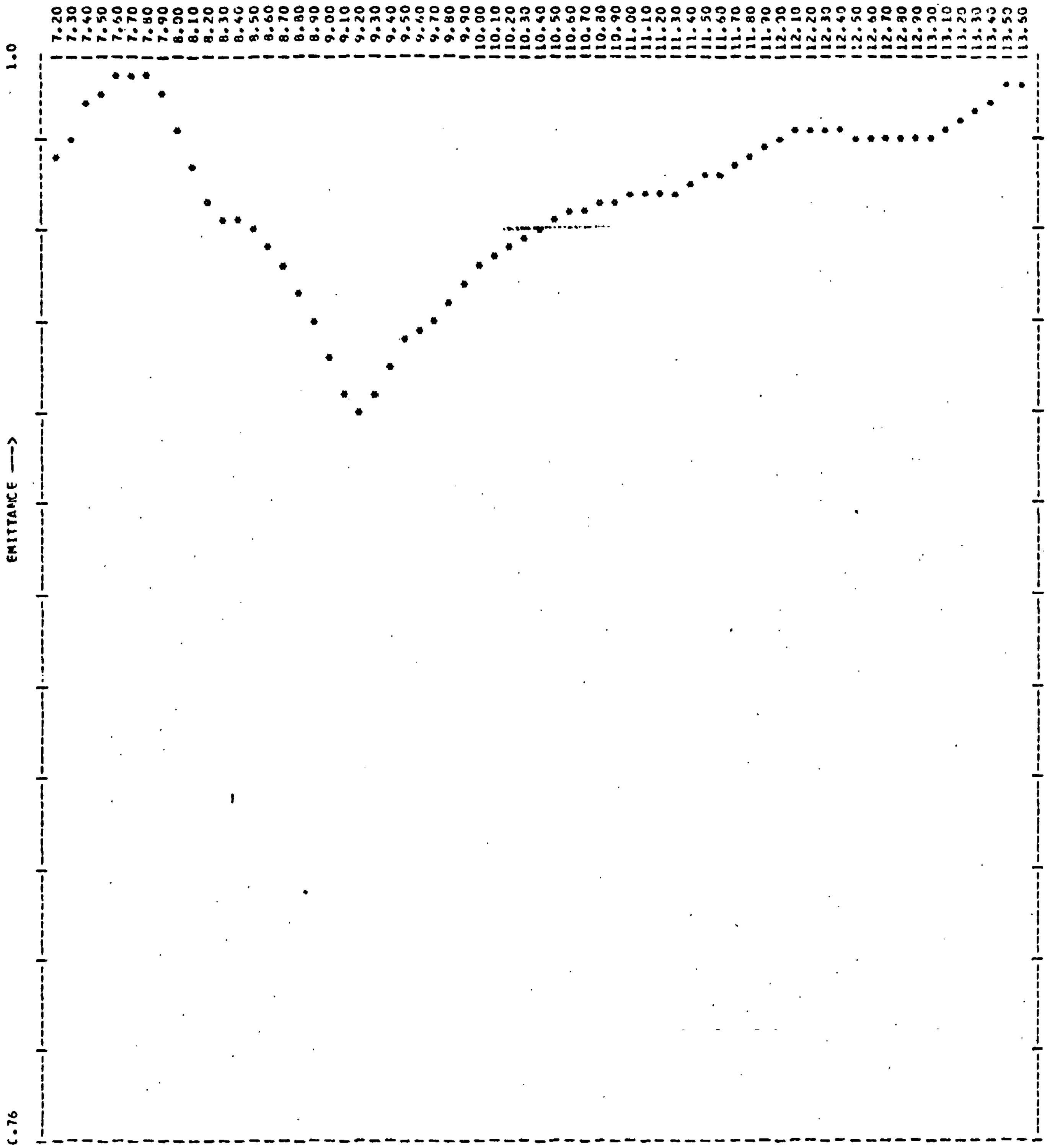
72 07 18 1145 SONORA PASS BULL QUARTZ
YC=-0.300 CALIB. DIST.=-1.75 VOLTS PER INCH= 0.1714 OHMS= 451.00
INTERNAL REF. TEMPERATURE= 32.38 TARGET TEMPERATURE= 32.00
WAVELENGTH OF EMIT. MAX.= 7.50
TARGET TEMPERATURE (SPECTROMETER) = 31.85
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200 0.978	7.300 0.987	7.400 0.997	7.500 1.000	7.600 0.996	7.700 0.995	7.800 0.991	7.900 0.959
8.000 0.859	8.100 0.757	8.200 0.713	8.300 0.657	8.400 0.646	8.500 0.658	8.600 0.677	8.700 0.676
8.800 0.655	8.900 0.633	9.000 0.623	9.100 0.614	9.200 0.624	9.300 0.654	9.400 0.716	9.500 0.788
9.600 0.839	9.700 0.866	9.800 0.882	9.900 0.893	10.000 0.905	10.100 0.911	10.200 0.917	10.300 0.922
10.400 0.927	10.500 0.932	10.600 0.935	10.700 0.938	10.800 0.941	10.900 0.943	11.000 0.946	11.100 0.949
11.200 0.951	11.300 0.952	11.400 0.953	11.500 0.955	11.600 0.957	11.700 0.961	11.800 0.964	11.900 0.966
12.000 0.970	12.100 0.973	12.200 0.977	12.300 0.960	12.400 0.937	12.500 0.914	12.600 0.892	12.700 0.878
12.800 0.869	12.900 0.875	13.000 0.896	13.100 0.921	13.200 0.943	13.300 0.966	13.400 0.970	13.500 0.975
13.600 0.976							



72 07 18 1205 MONO LAKE BLACK PUMICE
YC=-0.360 CALIB. DIST.=-6.15 VOLTS PER INCH= 0.0488 CPS= 451.20
INTERNAL REF. TEMPERATURE = 33.31 TARGET TEMPERATURE= 0.00
WAVELENGTH OF EMIT. MAX.= 7.71
TARGET TEMPERATURE (SPECTROMETER) = 31.80
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.985	7.300	0.996	7.400	0.995	7.500	0.997	7.600	0.998	7.700	1.000	7.800	0.999	7.900	0.993
8.000	0.983	8.100	0.974	8.200	0.966	8.300	0.963	8.400	0.962	8.500	0.959	8.600	0.957	8.700	0.952
8.800	0.945	8.900	0.937	9.000	0.926	9.100	0.916	9.200	0.913	9.300	0.916	9.400	0.925	9.500	0.932
9.600	0.937	9.700	0.941	9.800	0.945	9.900	0.948	10.000	0.952	10.100	0.956	10.200	0.961	10.300	0.964
10.400	0.967	10.500	0.969	10.600	0.970	10.700	0.972	10.800	0.974	10.900	0.975	11.000	0.976	11.100	0.977
11.200	0.978	11.300	0.979	11.400	0.980	11.500	0.981	11.600	0.983	11.700	0.985	11.800	0.986	11.900	0.987
12.000	0.987	12.100	0.987	12.200	0.987	12.300	0.988	12.400	0.988	12.500	0.988	12.600	0.988	12.700	0.987
12.800	0.987	12.900	0.987	13.000	0.988	13.100	0.990	13.200	0.993	13.300	0.994	13.400	0.997	13.500	0.997
13.600	0.99[illegible]														



72 07 18 1210 MONO LAKE GREY PUMICE
YC=-0.300 CALIB. DIST.=-6.59 VOLTS PER INCH= 0.0455 DIMS= 451.50
INTERNAL REF. TEMPERATURE= 33.20 TARGET TEMPERATURE= 0.00
WAVELENGTH OF EMIT. MAX.= 7.75
TARGET TEMPERATURE (SPECTROMETER) = 32.63
EMITTANCES AT SPECIFIC WAVELENGTHS

7.200	0.979	7.300	0.983	7.400	0.990	7.500	0.993	7.600	0.997	7.700	0.998	7.800	0.998	7.900	0.994
8.000	0.986	8.100	0.977	8.200	0.970	8.300	0.966	8.400	0.964	8.500	0.962	8.600	0.960	8.700	0.95[illegible]
8.800	0.949	8.900	0.942	9.000	0.934	9.100	0.926	9.200	0.924	9.300	0.927	9.400	0.933	9.500	0.939
9.600	0.942	9.700	0.944	9.800	0.948	9.900	0.951	10.000	0.955	10.100	0.957	10.200	0.959	10.300	0.961
10.400	0.963	10.500	0.965	10.600	0.966	10.700	0.968	10.800	0.969	10.900	0.969	11.000	0.970	11.100	0.970
11.200	0.971	11.300	0.971	11.400	0.973	11.500	0.974	11.600	0.976	11.700	0.977	11.800	0.979	11.900	0.982
12.000	0.983	12.100	0.984	12.200	0.985	12.300	0.984	12.400	0.984	12.500	0.984	12.600	0.984	12.700	0.984
12.800	0.983	12.900	0.982	13.000	0.983	13.100	0.985	13.200	0.987	13.300	0.989	13.400	0.991	13.500	0.996
13.600	0.995														

ACKNOWLEDGEMENTS

We are extremely grateful for the assistance provided by Mr. Jack Quade of the University of Nevada who supplied all the samples used in the Spectral Emittance measurements and their mineralogical descriptions. Our thanks also go to Dr. W. Ervine for his help in the preparation of this report.